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CONTENTS.

EDITORIALS:
- Scientific Principles of Street Lighting.....975
- Simplifying Power-Contract Negotiations.....976
- Trouble Shooting and the Technical Graduate.....977
- Group or Individual Drive.....977
- Thermo-Electric Properties of Alloy-Steels.....977

DEPARTMENTS:
- Commercial Practice 983
- Electrical Construction 985
- Dollar Wiring Kinks.....990
- Public Service Commissions.....991
- Questions and Answers.....992
- New Electrical and Mechanical Appliances.....1005
- Current Electrical News.....1011
- Record of Electrical Patents.....1015

LEADING ARTICLES:
- Electricity in Chair Manufacturing.....979
- Electric Elevators, Operation and Maintenance.—II.—By A. C. Bender.....985
- Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon.....993
- Southwestern Electrical and Gas Association.....996
- Electrical Sounding.—By Henry R. Gilson.....1002

MISCELLANEOUS:
- Electric Club of Chicago Discusses Electrical Prosperity Week 975
- Chicago Jovian League Votes to Amalgamate With Electric Club 978
- Ohio Tax Decision.....978
- Civil Service Examination for Electrical Engineer.....978
- Special City Illumination for Convention of Missouri Elks 978
- Specialists Discuss Lumber Investigations and Experiments 982
- Free Current For Cooking in Tacoma Apartments.....982
- Spectacular Sign of Ford Motor Company.....983
- Ohio New-Business Meeting.....984
- The Electrification of Mills at Bombay.....984
- Among the Contractors.....985
- Practical Notes on Rotary Converters.....989
- Telephone Pioneers to Meet in San Francisco.....991
- Philadelphia Section Meeting.....995
- Principles of Scientific Street Lighting.....999
- How Bell Invented the Telephone.....1000
- Meeting of Electric Power Club.....1001
- The Lighting of the Pompeian Room, Hotel Statler, Cleveland 1003
- Development in Hydroelectric Units.....1004

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SCIENTIFIC PRINCIPLES OF STREET LIGHTING.

Great differences of opinion have existed up to the present as to what constitutes good street lighting. This is particularly true in the popular notions of the subject. The opinion, for instance, is altogether too common that the more light there is in a street the better is its lighting, and this is the opinion not only on the part of the general public but of municipal authorities charged with the responsibility for street lighting. This lack of agreement is due largely to failure to understand clearly what are the primary objects to be sought in street lighting and of the requirements to be met in order to secure effective outdoor vision at night. Despite the progress of the art, no comprehensive study of the scientific aspects of street lighting has been made until recently.

Such a study was made public by Mr. Arthur J. Sweet in a paper presented before the Chicago Section of the Illuminating Engineering Society last week and abstracted in another part of this issue. This paper, which was based on investigations extended over several years, is refreshing in the breadth of its scope and the clear and logical analysis it makes of the requirements and desiderata of a scientifically designed street-lighting system. Although many of the facts brought out by the author have been well known for some years they have probably never been formulated in a single compact treatise on the subject.

Mr. Sweet rightly recognizes safety and convenience of the public as the major reasons for lighting city streets. In subdividing these major purposes he points out as three prime requisites the provision of ample illumination to insure safety from collision, safety from attack and convenience in recognizing the passer-by. Although he mentions other minor classifications under this head, he does not mention convenience in identifying streets and houses, which are prime requisites of the public in finding its destination when about on the streets at night. It is true that any street lighting that meets the requirements of safety and convenience, that Mr. Sweet points out as the most important, will also satisfy convenience in identifying streets and houses, yet it is well to recognize this as being one of the important and desirable purposes of street lighting, particularly in view of the fact that house numbers are as yet so seldom illuminated.

In discerning objects on the street at night Mr.

Sweet shows that we make use for the most part either of silhouette effect or illumination effect, and he emphasizes the fact that although the former is the one that must be most commonly depended on in ordinary street-lighting installations with lamps widely spaced, yet discernment by illumination effect is by far the more satisfactory means of visualizing objects at night. It is the only one, in fact, which satisfies all of the requirements that street lighting should meet.

Moreover, discernment by illumination effect implies that at every point in the street there shall be such minimum illumination as is ample to identify objects by light falling upon them directly. Since absolute uniformity of illumination is out of the question, this requirement is met by having the ratio of maximum to minimum illumination range from about 5 to 1 to 10 to 1. While the minimum intensity of illumination, both on horizontal and vertical planes, may be regarded as the criterion of good illumination from this standpoint and any excess illumination in the immediate vicinity of lamps may do no harm, yet Mr. Sweet shows that such excess, beyond the reasonable ratio mentioned above, is pure waste and, if possible, instead of wasting such maximum illumination it is desirable to use the energy in raising the minimum between lighting units. To provide the minimum found necessary for a reliable discernment by illumination effect an intensity of 0.02 foot-candle is necessary and Mr. Sweet finds that this involves an expenditure per running foot of street of approximately 15 cents per year with the best type of equipment now available. As such an expenditure is approximately double that which is now made in the street lighting of residence districts at least, and since anything less than this amount would produce a uniform illumination of too meager an intensity, Mr. Sweet recommends that no effort be made to secure strict or even reasonable uniformity unless ample funds are available. On the contrary, he recommends that reliance should be placed on silhouette-effect lighting with relatively widely spaced units until the public has been educated to provide more liberally in street-lighting appropriations, at which time additional lamps can be inserted at intermediate points to provide the uniformity of illumination necessary for discernment by illumination effect.

Some simple and common-sense principles are laid down by the author as a guide in selecting street-lighting equipment. Although it may seem self-evident to say that the light must be generated economically and utilized economically and in such a manner as to preclude the eye from inefficient vision, yet violation of these simple principles is extremely common. Much attention has been given in recent years, through the development of high-efficiency units, to the first of these considerations. To the second, however, less recognition has been given, and we find a great deal of light wasted by being thrown upward toward the sky. To the third consideration practically no attention has been given at all, as is evidenced by the glaring installations of what are commonly supposed to be well lighted streets. The requirements in this connection, and the loss of ability to see due to low mounting heights, were fully brought out in an article by Mr. Sweet in our issue of March 6.

The practical value of the curves set forth in Mr. Sweet's paper cannot be emphasized too much in a proper selection of lamp spacing and mounting height and of such choice of distribution curves as will give the best results if uniformity of illumination is sought. Fortunately, by reducing the spacing between lamps and by increasing their height the very important blinding effect produced by low lamp suspensions is greatly diminished, while at the same time the uniformity of illumination is greatly improved.

This method of procedure seems the only practical one to follow, as we cannot hope to secure lighting units which will give the necessary distribution of light flux when spaced widely apart. Moreover, since the distribution which would be required involves the emission of large amounts of light at angles not far from the horizontal, such a distribution would make the worst condition of glare.

While there may be points in Mr. Sweet's paper upon which illuminating engineers still differ, such for instance as the opinion that standard street-lighting equipment cannot as a rule be depended on for securing illumination of building fronts, nevertheless there is so much of value in his paper that publication in full will be eagerly awaited by every student of street-lighting problems.

SIMPLIFYING POWER-CONTRACT NEGOTIATIONS.

In dealing with a large power prospect having recourse to engineering advice, the central-station new-business department often finds it possible to agree upon the potential customer's figures, with a few exceptions. An estimate of central-station service cost goes in, and then the customer's engineer replies to the company with points of disagreement as to the amount of the demand figured, the percentage of depreciation allowed, maintenance requirements or what not. The important thing after this is to concentrate on these points of disagreement, just as in any well conducted negotiations. It pays to figure estimates in questioned cases from every possible angle, using the prospect's own figures wherever it is feasible.

Even if a final agreement cannot be reached as to one or two allowed items in the estimate, it may still be possible to sign the contract on a trial basis which will show by experience what figures are most nearly correct. "Never say die" is a motto which is worth sticking to in power negotiations, which often are worth the best effort of central-station engineers.

TROUBLE SHOOTING AND THE TECHNICAL GRADUATE.

The advent of the commencement season calls to mind the perennial problem of the newly fledged graduate relative to getting a fair start in his profession. A large part of the work in the electrical operating field is necessarily of a routine nature, but so are early hospital training, employment in the testing departments of manufacturing plants, and activities in business houses.

Efforts toward acquiring practical experience in hunting troubles are sure to bring their reward, once a man gets into this branch of operating service. In these days a great deal more attention is being paid to the prevention and prompt removal of trouble on distribution systems, in power plants and telephone exchanges than many people appreciate. The growth of the service has made interruptions so costly on most large systems and on many smaller ones that the best engineering talent is concerned to maintain continuity of supply. For getting right at the heart of things, nothing can surpass in opportunities even a modest association with the work of trouble "shooting." It demands a man's best efforts absolutely, without regard to office hours, sleep, or social pleasures, but it gives invaluable experience. A young chap fresh from school can read about apparatus designs until his hair grows gray without learning the limitations of equipment as he can in a few months of work with the line gang or the inspectors, supposing he is fortunate enough and blessed with sufficient determination to stick out his term of rough, hard service in humble jobs which in themselves require no knowledge of calculus or of strain sheets, but the ability to count and measure accurately, to think quickly and to obey orders implicitly.

With the right sort of man the technical training he has received will come duly into play as time goes on, and on the basis of actual operating experience he is sure to become a more valuable advisor of others or originator of developments in the future.

GROUP OR INDIVIDUAL DRIVE.

Whether individual or group driving by electric motors is preferable depends largely upon the conditions of the particular installation. Where a number of machines are to be driven at constant speed and are in service during the same hours, group drive will frequently be entirely suitable and has the advantage over individual drive of lower first cost. Even where some speed changes are essential they can, if made infrequently and to different fixed values, be obtained by the use of belt and cone pulleys. When, however, a continuous range in speed such as can be obtained by motor regulation is desired, it is necessary to have an individual motor for the particular machine. This is generally desirable in a machine shop, where the rate of cutting must be adjusted to the material in order to secure the best output in maximum quantity. Electric drive with individual motors makes accurate and unbroken speed control possible over a wider range than can be secured by any other means. The high cutting speeds which have come into use with modern tool steel have led to the necessity of providing more power for a machine than would be necessary under the old conditions. This is sometimes overlooked in selecting the motor drive for a machine tool and it is well to actually measure the power required under any given circumstances by connecting a motor up temporarily rather than to run the risk of too wide a range of either undermotoring or overmotoring.

THERMO-ELECTRIC PROPERTIES OF ALLOY-STEELS.

The problem of determining the various properties of alloy-steels and their dependence upon the relative proportions of their ingredients and upon the heat treatment which they have received is a very complicated one and years of experimentation have been required to even partially work it out. Microscopic examinations have aided greatly in researches of this character, owing to the fact that the properties depend largely upon the molecular structure and this structure affects the appearance of the metal as seen through the microscope. This is largely due to the fact that certain proportions of the alloying metals appear to form definite chemical compounds with the iron, whereas in other proportions a mere mechanical mixture results.

An investigation into the thermo-electric properties of steels containing different proportions of nickel, chromium, manganese, aluminum, silicon, tungsten, and molybdenum have recently been carried out by Messrs. Dupuy and Portevin in France, and were reported at the annual meeting of the Iron and Steel Institute held in London this month. These measurements were undertaken over two ranges of temperature, one from zero to 100 degrees centigrade, and the other from zero to minus 80 degrees. The variation of the thermo-electric power for these ranges with the percentage of alloyed metal was found and certain generalizations were deduced from their results.

In the case of a mixture of two phases the relation between thermo-electric power and percentage of alloyed metal is found to be approximately a straight line. In the case of a solid solution, on the other hand, the curve has the shape of one branch of a hyperbola and the convexity may be either upward or downward. The variation is greatest with the steels containing nickel, manganese, silicon, and aluminum.

The authors conclude that it may be possible from the shape of such curves to form an idea of the limit of solubility in the solid state of the special metals added to the steels. It is made evident here as in so many previous investigations that the various properties of such alloys are bound together through their dependence upon some determining condition, so that a measurement of one property may serve as an index of at least an approximate value of others.

Electric Club of Chicago Discusses Electrical Prosperity Week.

One of the most interesting meetings recently held by the Electric Club of Chicago, was that of Thursday, May 20, when George B. Muldaur, in charge of the field work of the Society for Electrical Development, delivered an address relating to the organization of the Society, its present plan and its prospective development of Electrical Prosperity Week. The address was supplemented with stereopticon illustrations of examples of the Society's propaganda, and Mr. Muldaur's presentation aroused great enthusiasm among the members who have pledged themselves to co-operate to the fullest extent with the Society in making Electrical Prosperity Week, which will be held from November 29 to December 4, inclusive, a lasting success.

A resolution was presented expressing the regret of the Electric Club at the resignation of W. D. Ray from the office of vice-president. Resolutions extending to Mr. Ray the good wishes of the club were also presented. Mr. Ray goes to Easton, Pa., in charge of the properties of the American Utilities Company.

Chicago Jovian League Votes to Amalgamate with Electric Club.

At its regular meeting on Monday, May 24, the Chicago Jovian League voted unanimously to consolidate with the Electric Club of Chicago. First Tribune Victor H. Tousley and Second Tribune Morgan Ellis become officers of the Electric Club, and they will be in charge of all local Jovian activities.

Through the courtesy of B. M. Graybill, a very pleasant cabaret entertainment was rendered.

The retiring board of managers of the Chicago Jovian League was constituted a committee to liquidate the affairs of the Chicago Jovian League, and at a special meeting held on Tuesday, May 25, Mr. Tousley announced that sufficient funds had been secured by personal contributions to entirely clear up all deficits.

Ohio Tax Decision.

The Supreme Court of Ohio has held that, under the tax laws of the state, electric railways operating in Ohio are compelled to pay state excise tax of 1.2 per cent of their gross earnings only on the revenue actually derived from operation of their lines and that the excise tax does not apply to income from investments or other sources. By this decision electric railways of Ohio will be relieved from the payment of a large amount of taxes, as the state had undertaken to hold them for the excise tax on the entire amount of their earnings. The decision does not apply to other public-utility corporations, as in their case the law levies the excise tax on their "gross receipts," while in the case of the electric railways it is levied on "gross earnings."

Civil Service Examination for Electrical Engineer.

The United States Civil Service Commission has announced an open competitive examination for electrical engineer and draftsman to be held on June 23 and 24 at the usual places for the purpose of filling vacancies in the office of the supervising architect of the Treasury Department at $1,200 a year, and other positions requiring similar qualifications. Competitors will be examined on theoretical and practical questions in electrical science, with special reference to lighting and elevator work in public buildings; also drawing and designing, involving the ability to draw plans for apparatus and machinery connected with electrical work. Training and experience will count for 35 per cent of the total rating. Applicants must have the equivalent of a high school education and not less than three years' experience as a draftsman.

Electrochemical Convention.

The twenty-eighth general meeting of the American Electrochemical Society will be held in San Francisco, Cal., September 16 to 18. This meeting occurs during the week preceding the International Engineering Congress and during the week in which meetings are planned by the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers and the American Institute of Mining Engineers. It is expected that joint sessions will be arranged with some of these societies.

Changes in Tech Instructing Staff.

R. J. Wiseman and Albert C. Brown were appointed assistants in electrical engineering at the last meeting of the Executive Committee of the Massachusetts Institute of Technology, the resignation of Thomas Buel, research assistant in electrical engineering, being accepted.

H. A. Affel, D. J. McGrath, E. W. Chapin and O. R. Schurig were reappointed research assistants in electrical engineering and H. O. Taylor research associate in electrical engineering.

Pennsylvania Convention.

The 1915 convention of the Pennsylvania Electric Association, the state branch of the National Electric Light Association, will be held at Bedford Springs, Pa., on September 8, 9 and 10.

Special City Illumination for Convention of Missouri Elks.

The annual convention of the State Elks of Missouri will be held at Sedalia, Mo., June 2-4, and the City Light and Traction Company has arranged an elaborate street lighting and electrical effect. There will be something over 100 stringers of lights in connection with the colors in the down-town streets, some 15 or 20 large electrical set pieces, which have been obtained from the Valentine Electric Company, of Atlantic City, N. J., and the Greenwood Advertising Company, of Knoxville, Tenn. Several additional signs have been sold, to be erected by this time, so that the extra lighting put up for this event in connection with the "Do It Electrically" sign that the company already has and the goodly number which the merchants have will make a splendid showing in this city of 20,000 people.

The larger lodges from St. Louis, Kansas City, St. Joseph, Springfield and Joplin will all have large representation, and it is believed that this display will be quite a stimulus to the people from the different towns of Missouri that visit Sedalia that week, and will materially boost electric lighting in that part of the country.

New England Section Convention.

The New England Section of the National Electric Light Association will hold its seventh annual convention at the Mount Kineo House, Kineo, Me., September 14 to 17.

The New England Section, National Electric Light Association, has added 250 new members since January 1, making the total membership at present 1,100. The Rumford Falls Light & Water Company, Rumford, Me., furnished 30 new members; the Cambridge Electric Light Company, 30, and the Plymouth Electric Light Company, Plymouth, Mass, 19 members.

The Rumford and the Woonsocket (R. I.) companies have taken out company memberships.

A campaign conducted among electrical contractors has resulted in the addition of a number of men in this branch of the industry to the Section membership.

Iron and Steel Engineers Meeting.

The next monthly meeting of the Association of Iron and Steel Electrical Engineers will be held at the German Club, 222 Craft Avenue, Pittsburgh, Pa., on Saturday, June 5, at 7:30 p. m. This meeting will be a smoker at which there will be a general discussion of any matters of interest that may be brought up. There will also be an entertainment program, including music, motion pictures, monologs and magic.

Electricity in Chair Manufacturing.

This article describes the motor installation in a large chair factory located in Massachusetts. The total installation, aggregating 1,800 horspeower, has been substituted for a mechanical system previously employed. Advantanges of motor drive for woodworking plants are briefly discussed.

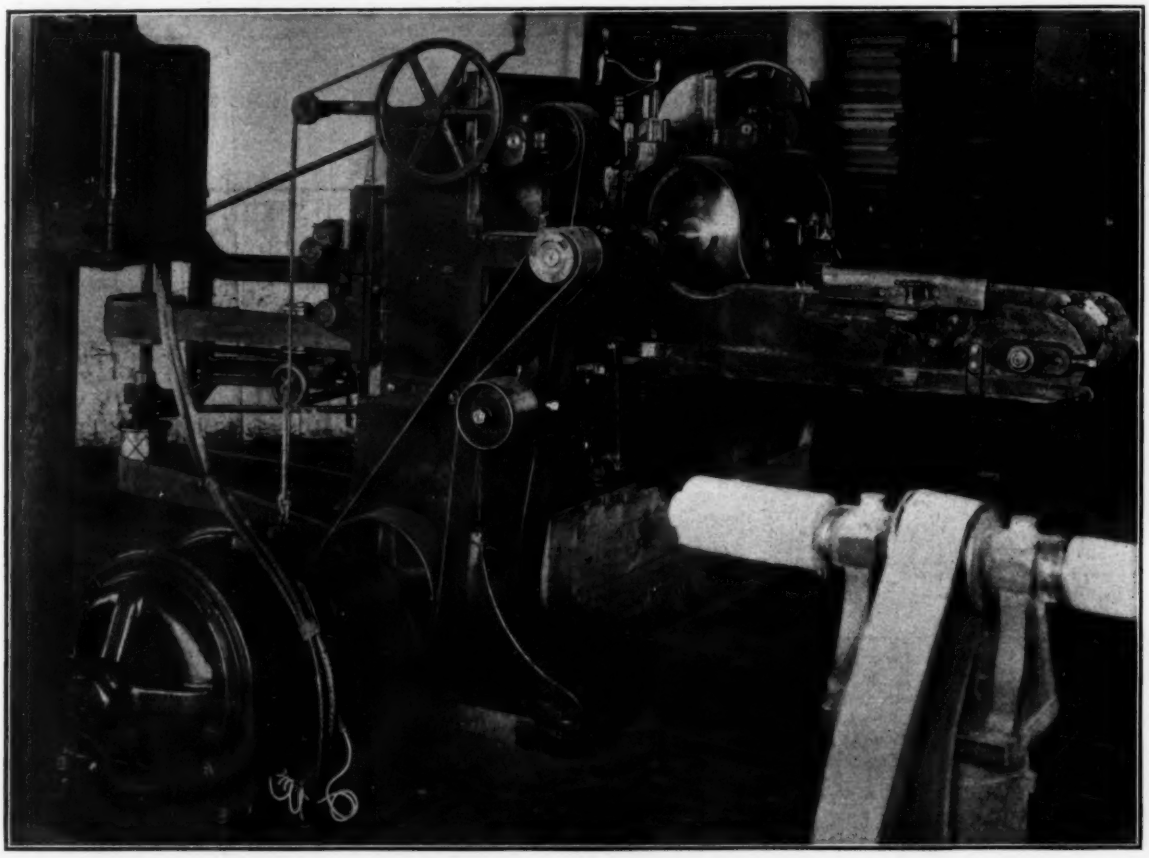
The fact that electric drive is the most efficient and economical in woodworking establishments is demonstrated by the complete installation in the factory of the Heywood Brothers & Wakefield Company, at Gardner, Mass. This is said to be the largest chair factory in the world; it comprises about 13 acres of floor space, in substantial modern brick buildiings; and normally about 1,500 persons are employed.

Nearly 200 motors are installed, of one-eighth to 35 horsepower, totalling 1,800 horsepower. Most of the motors are of the induction type, and are operated on three-phase 550-volt energy.

The substitution of electric drive for mechanical drive with line shafting was begun several years ago, until now it is complete. Part of the machines are operated in groups from short shafts direct-connected to their respective motors, but for the most part the drive is with individual motors. The latter plan is particularly advantageous for machines which are operated intermittently, or those which, like saws, planers and boring machines, make a quick cut, followed by a considerable period of no load. The construction of induction motors with wide provision for temporary overloads is especially favorable to woodworking operations. The fact that motors of the induction type are free from the danger of sparking makes it proper to operate them without being inclosed. A conspicuous advantage of individual drive is the freedom which a mill enjoys from not having overhead shafting, which, besides being dangerous, involves a continual jar to the floors, which often makes skillful operation of machines difficult. It is held that motor drive makes possible a construction economy in the building of at least five per cent, as compared with construction of the heavier type necessitated by line shafting.

It is stated that under former conditions of operation the friction loss of the line shafting in one mill at Gardner amounted to 65 per cent.

A noteworthy feature of the Heywood installation is the use of flexible couplings in direct connection between motors and machine axles, or with driving shafts. The Grundy type of coupling is extensively used, and also those of General Electric and other makes. Early installations involved considerable difficulties with shaft alinement, and the use of solid metal bases for motor and machine bearings on a single frame was general. These were made in the factory's own machine shop, but later installations have been supplied by the motor manufacturers, these being of lower cost than shop-made bases. The Heywood plant was one of the first to adopt electric drive, and its adaptations of motors to the earlier machines that were not designed to be electrically operated in-



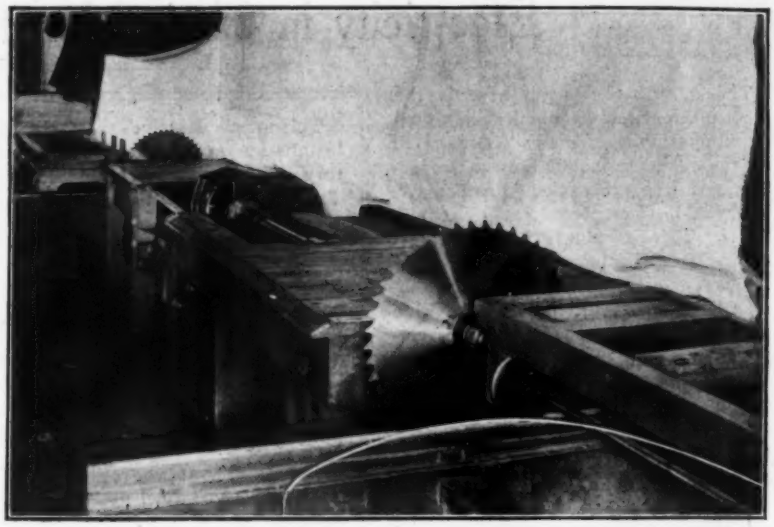
Individual Motor Application in Plant of Heywood Brothers & Wakefield Company.

volved considerable ingenuity. The constant study of more efficient modes of connection, etc., has been of benefit to manufacturers of both motors and woodworking machinery, and many devices originating in the Heywood factory have become standard.

The adoption of the direct-connected plan for operating circular saws and other edge tools has necessitated the installation of motors of very high speeds. Here motors rated 3,600 revolutions per minute are common, in connection with cut-off saws and like tools requiring a rapid rotation. In many cases two saws are operated by one motor centrally located between them on a single bed plate. Circular saws of 24 and 28 inches diameter are driven in pairs by 5 or 7.5-horsepower motors direct-connected, with flexible coupling connection. These particular saws operate at a speed of 1,800 revolutions per minute. Band saws are driven by 7.5-horsepower motors located on the floor, with wood frame and cover for protection.

Four molders are operated from a line shaft by a 15-horsepower motor. The large diversity-factor of these machines makes it proper to operate them from a motor of moderate capacity, which is held to be more economical of energy than the installation of individual motors. The cutting operation requires but a small fraction of time.

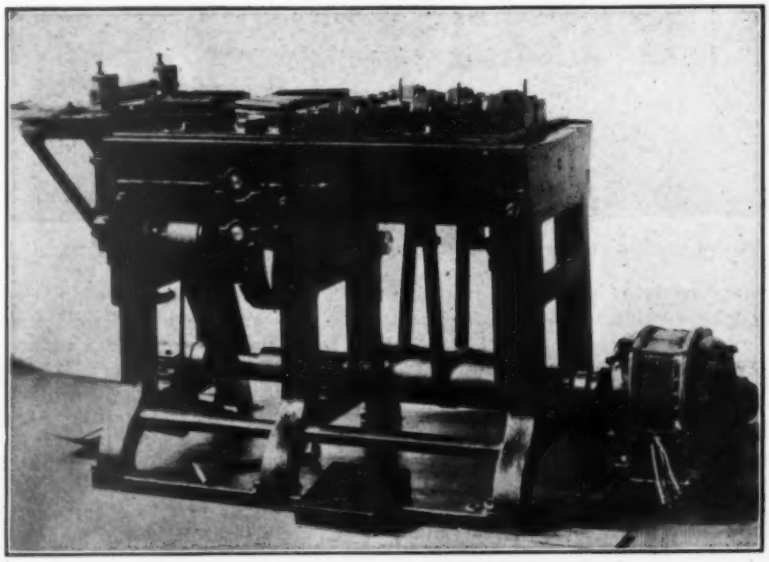
Another instance of group drive is the operation of six dowel-turning lathes from an overhead shaft, which is direct-connected to a 25-horsepower motor running at a speed of 1,200 revolutions per minute, through a Grundy flexible coupling. For lathes of larger size, used for other purposes, economy of power and efficiency of operation is obtained through placing the motor directly on the frame of the machine, with a short belt connection. In these instances power requirement was reduced from five horsepower to three horsepower per machine by removing the motor from its inverted position against the ceiling and locating it on the machine frame.



Motor With Extended Shaft Driving Rip Saws.

Another instance of group drive of advantageous characteristics is the operation of two sanding machines and a 32-inch blower fan by one 10-horsepower motor. These machines run continuously, and the removal of their waste is a constant requirement, hence no great benefit would be derived from individual motorization.

Boring machines in the mill are operated by individual three-horsepower vertical-shaft motors. Some of the early ins'allations were adaptations of horizontal-shaft motors, with step bearings. A group of six two-spindle Variety and Whitney shapers, now operated (each machine) by a five-horsepower, 1,800-revolutions-per-minute induction motor located on the floor between two pulleys, whence belts are connected by a quarter turn with the shafts of the shapers, are soon to be re-equipped with three-horsepower vertical-shaft motors, one motor for each spindle. By this means a great deal of friction loss will be saved, and more efficient operation will result, the five-horsepower motor on each machine now being somewhat overloaded. The new motors will be erected on adjustable iron bases, with screw adjustment, to provide for tightening the belt slack.

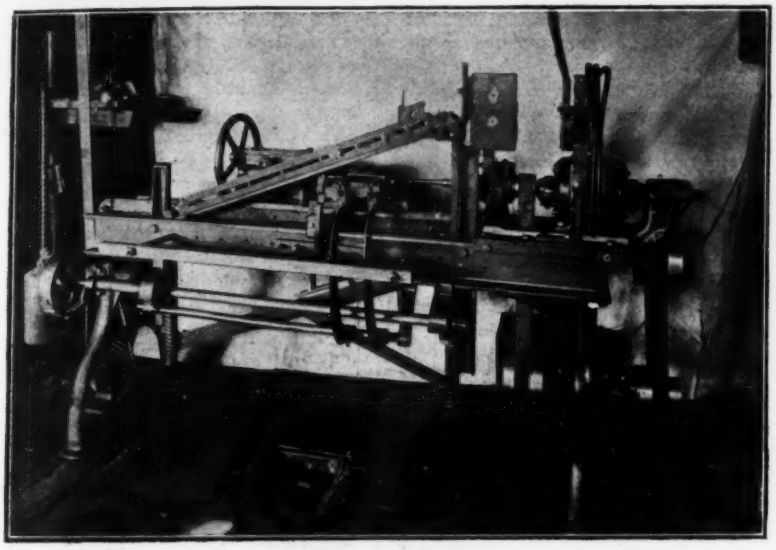


Motor Direct-Connected to Sander.

Among the interesting machines operated in the Heywood factory are nail drivers, which are used to drive the metal fastenings that connect the several portions of the chair frames. These are individually motored with 0.25-horsepower motors, belt-connected. Another machine is a combination screw driver and auger. This is constructed so that either tool can be attached to the flexible Coates-Clipper shaft by means of a bayonet hitch. A one-horsepower motor, installed from the ceiling beams, drives each of these machines.

The manufacture of cane-seated chairs requires a vast number of splaines. Most saws cut only one splaine at a time, but a machine was built and is driven by a five-horsepower motor at 1,800 revolutions per minute which cuts 10 splaines at one operation, effecting a great economy.

Another machine operated by one motor is a combination of two machines, one a four-spindle dowel-boring machine and the other a frame-cutting machine. A 75-horsepower motor, op-



Motor Driving Lathe.

erating at 1,800 revolutions per minute, is direct-connected to the driving shaft of the framing machine, which in turn is belted to the shaft of the boring machine.

Tool grinders are arranged in a gang of six emery wheels, driven directly by a one-horsepower induction motor at 1,800 revolutions per minute.

A jig saw equipped with a small self-contained centrifugal blower, both driven by a single motor, is another feature of the Heywood plant. This unit is thus made independent of the air exhaust system in the factory, and obviates the expense attendant on running an air conduit to the machine.

A group drive is employed for iron-working machines, which include shears, punches and blanking presses producing hardware for baby carriages. Another instance of economical group drive is the motorization of 10 boring machines for small work with a five-horsepower motor, the machines being connected from line shaft installed on the ceiling timbers under the machines, the belts passing through the floor. Here the operation is intermittent, and the power requirement of each machine is very small, so that as good economy-factor is obtained as with the use of individual drive.

Electrically heated glue pots are in use throughout the factory. These are of Westinghouse and several other makes, and are generally rated at 3.8 amperes, 110 volts.

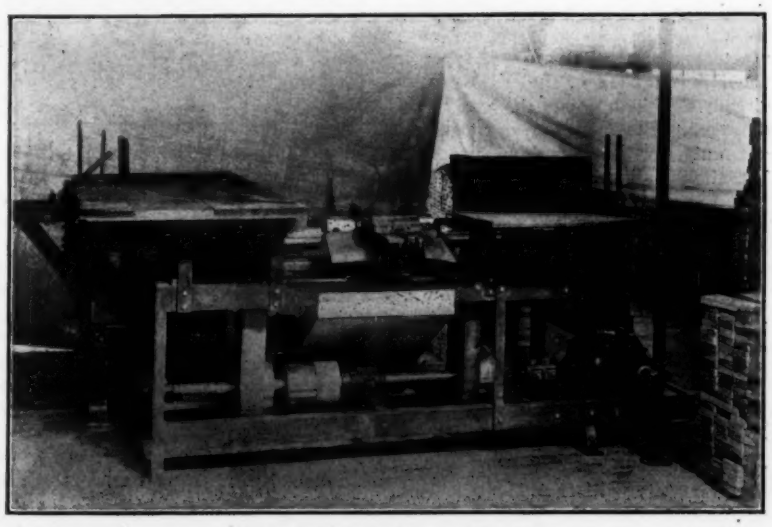
The factory machine shop is thoroughly equipped with lathes, grinders, boring mills, emery wheels, shears, punches, etc., all of which are driven by a 15-horsepower induction motor from line shaft. Here, of course, only a part of the apparatus is operated at one time, hence a good diversity-factor making for economical operation by the group-drive plan.

A complete system of blowers is installed throughout the works, to provide for the removal of wood waste from the various rooms to the boiler plant. All the fans are of the Allington Curtis slow-speed type, and are of sizes varying from 32 to 70 inches in diameter. The direct-connected motors operating these fans are of 5 to 25-horsepower rating. In certain cases a single motor operates two fans, both direct-connected on a single shaft, with air conduit serving two woodworking machines.

A 40-cell Automatic Transportation Company (Buffalo, N. Y.) electric tractor is employed in the mill yards to haul cars of wood waste, edgings, etc., from the saw mill to the boiler house, a distance of about 900 feet. Three or four cars are attached and are hauled at a trip, each car containing about 100 cubic feet of wood. This means of handling and disposing of the waste materials is found to be very economical, and does the work, with one operator, formerly requiring four or five men. Part of the cars are provided with flanged wheels and operate over a track, while others have flat-tired wheels.

The lighting of the newer portions of the plant is abundant and admirably arranged. In a building completed a few weeks ago, which is of five stories, 60 by 120 feet, 100-watt Mazda lamps are installed in uniform bay spacing of 20 feet laterally, and at 15-foot intervals lengthwise of the building. The units are inclosed in concave white-enameled metal reflectors, painted green outside. A new two-ton freight elevator operates in this building, driven by a direct-connected 15-horsepower motor, at a rated speed of 75 feet a minute. Other elevators in earlier mills are operated by belt drive by their respective motors, but it is the company's plan to replace this relatively inefficient mode of operation with the more approved and recent type of motor drive, in the near future.

The care of the motors in the Heywood Brothers & Wakefield plant receives adequate, regular attention. Motors are blown out, cleaned and oiled, and their air gaps measured every week. A squad of two men, with a portable air compressor motored with a three-horsepower motor has this weekly duty in charge, with Friday as the day for this work. The prevalence of flying dust and wood particles in the air makes constant and frequent care and inspection of all motors imperative, and in this way motor troubles are reduced and kept at a minimum, and the life of the motors greatly prolonged.



Motor Driving Saw and Shaper.

To sum up the outstanding features of motor drive for chair and furniture factories, and, in fact, for all kinds of woodworking plants: First, it has been fully demonstrated, both in the great Heywood plant at Gardner, Mass.—the world-famous "Chair Town"—and in other factories, that the quality of product and the volume of output are both increased, with reduced cost of power. In this connection it should be stated that with the motor installation several boilers were discarded and removed from the boiler room at the Heywood Brothers plant. Second, fire hazard is reduced, the disagreeable and unwholesome woodworking dust is diminished through the elimination of much of the overhead shafting and long belts. Third, a marked economy in floor space results, with corresponding improvement in the appearance of factory rooms. Light and air are freer in a motorized shop than in one in which long lines of belting are traveling up and down. The factor of safety to employees is also greatly in favor of the motorized mill, and particularly the one having the largest per cent of individual drive.

Figures bearing on the subject of power economy vary, but a competent estimate indicates that for a given amount of production the operating expense so far as power costs are concerned has been reduced at least 30 per cent with the substitution of electrical for mechanical drive.

The induction motor, being compact and of light weight, can be mounted almost anywhere a stable base is provided. With the individual drive the frame of the machine is doubtless the ideal location, while for group drive the ceiling, with motor in inverted position, is perhaps the most practicable. Motor platforms are dust catchers, and there is always present the possibility that hangers or fastenings may become loosened. The general practice of manufacturers of machines of all types in providing a base or indeed a motor already attached, points the way to the most efficient operation of machines, not only for woodworking processes but almost all others.

Specialists Discuss Lumber Investigations and Experiments.

The nation-wide study of the lumber industry, which is being made jointly by the Department of Agriculture and the Department of Commerce, and the other industrial and technical investigations and experiments which have been carried on by the Forest Service in the last two years were discussed at a conference of Forest Service officials at Madison, Wis., on April 14 to 17.

The Forest Service Laboratory, the Washington office of Industrial Investigations, and each of the seven National Forest districts were represented at the conference by specialists. Among the subjects for discussion were: Co-operation of the Forest Service with industries, lumber distribution in the United States, utilization of low-grade lumber and mill waste, adaptation of manufacturing and grading to specific classes of consumers, unification and standardization of lumber grades, study and development of general markets for National Forest timber, mill-scale studies, including technical methods, tallying, etc., lumber depreciation, and the collection and compilation of lumber price data.

Information already collected by the Forest Service under some of these headings includes the most exhaustive data on the mechanical properties of wood ever collected by any agency in the world, and already has resulted in practical reforms and big savings to several of the important wood-using industries.

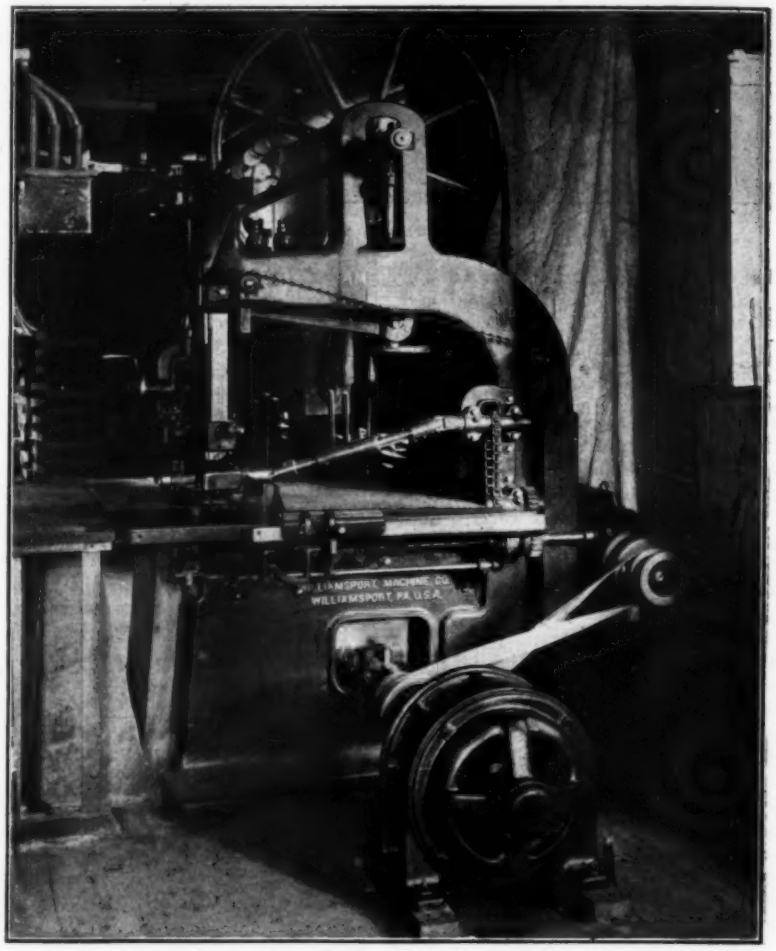
New Building for Johns Hopkins University.

The new engineering building of Johns Hopkins University was dedicated on May 21. Addresses were made by the President of the United States, by Gen. George W. Goethals and by Prof. Henry C. Adams.

On the day previous Frank J. Goodnow was inaugurated as president of the University.

Free Current for Cooking in Tacoma Apartments.

One of the best equipped apartment houses to be found anywhere is the new Ansonia in Tacoma, Wash., located at the corner of North Third Street and Tacoma Avenue. In addition to the usual features of a high-class apartment house the tenants in this building are supplied with free telephone service and free electrical current. There is an automatic electric elevator. The kitchens are provided with the latest model of Hughes electric ranges with four burners and warming hoods. The closets contain automatic switches for lighting them whenever the door is open. The lighting of these apartments is entirely electrical, and current for both lighting and cooking is supplied without extra charge.



Motor Belted Directly to Band Saw in Heywood Chair Factory.

Commercial Practice
Management, Rates, New Business

Spectacular Sign of Ford Motor Company.

The Ford Motor Company is usually in the van in advertising ideas. Not the least of these is an electric sign of novel design and large proportions which is erected on the company's Detroit factory. A counterpart of the original sign has been installed on the company's assembling plant at Cambridge, Mass., and another replica on the building used by the company in Philadelphia, Pa.

The sign consists of four sheet-iron panels, one above the other and attached to a framework of angle irons which stands on the roof of the building. The framework is 40 feet in length and the base is 16 feet wide, the steel work at the back forming a series of braces to the perpendicular frame.

The four panels are 44 feet long and respectively about 4, 6, 6 and 4 feet high, and are each painted with a distinctive background. The upper panel is painted to represent clouds, the next below has a background of a marine view, with an automobile in the foreground; the next panel is modeled with a red-glass background to simulate a brick wall, and the lower panel is plain, being covered with letters in arrangements that are changed from time to time. The top of the sign is 40 feet above the roof, which is 80 feet above the street.

Beginning with the upper panel, on which the cloud effect is pictured, the words "Watch the Fords Go By" are formed in white letters with 15-watt clear Mazda lamps. A rim of lamps are operated by a flasher, but those forming the letters burn continuously.

The second panel from the top, containing the automobile and water scene, is formed of 15-watt lamps outlining the painted vehicle and its occupants. The lamps are of four colors—red, green, yellow and white, and the groupings represent the following subjects: the red lamps are installed to represent and illuminate the wheels; the water is lighted by green lamps, as are also the veils of two women occupants.

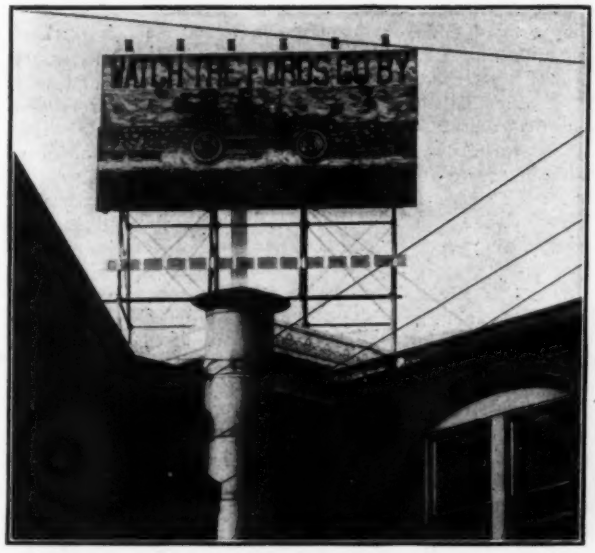
The panel below, which, as noted, is partly composed of dark red glass set in metal frame, has behind the glass, in a 24-inch operating box, an installation of 15-watt clear lamps, which are of fixed light and give the effect of a stone wall. Clear glass openings with lamps behind represent the roadway, and flashing white lamps represent the flying dust in the automobile's trail.

The lowest panel of all carries simply the words "Get Your Orders in Early," or some other seasonable phrase, the letters being of the illuminated, interchangeable type.

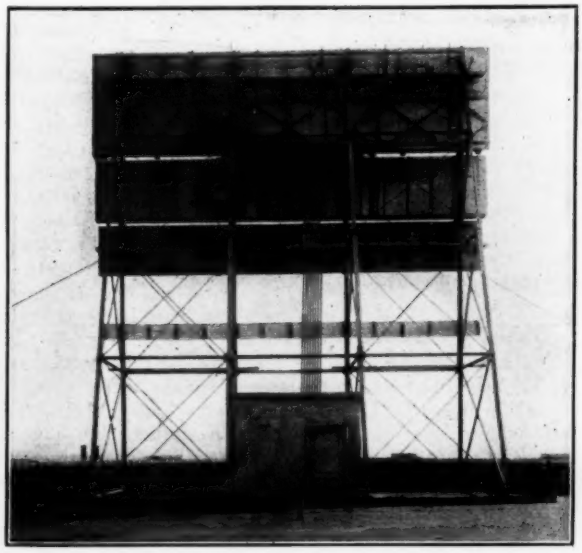
The distribution switchboard and flashers are housed in a concrete structure at the base of the sign, 10 feet square. There are six contact-ring wheels, five of them with 17 rings and one with 11. The wheels are of bronze, with fiber segments attached with rawhide pins. The flasher is driven by a 0.25-horsepower motor on the Cambridge Electric Light Company's 220-volt alternating-current service, operating through reduction gears to give slow speed to the rings.

There are 34 contacts for the "wheel" lamps, 34 for the "water," 17 for the "dust," and 11 for the "veils." The "wheels" and "water" rings are given a speed of 80 revolutions per minute, and that for the dust has a speed of 40 revolutions. The veils and water are both given a rapid rippling motion, the contact rings operating at 40 revolutions per minute, with close contacts. The whole mechanism, and the sign itself was produced by the Ford Company's electrical men and mechanics in its machine shops on the premises.

In addition to the lamps installed on the face of the sign, there are seven overhanging brackets, each carrying two 100-watt Mazda lamps in close, deep reflectors, hung about four feet in front of the sign, to reflect on the "water" panel. At the top of the steel framework are four steel brackets, at equal intervals, hinged to the frame and capable of be-



Ford Automobile Sign on Assembly Plant at Cambridge.



Rear View of Sign Showing Supporting Framework.

ing thrown over to a position at the front of the sign, there to be used as a means of attachment for block and tackle on which to suspend staging for use in working on the sign.

Conduit in sizes of 2 inches, 1.5 inches, and 0.75 inch is used in carrying the feed wires from the distribution board in the structure to junction boxes which are installed on the back of the sign panels. The marble switchboard is supported on a structure of angle irons, and on it are installed a switch for the sign above and one for control of other signs on the central water tank on the roof. These latter are two words "Ford," one on the southwest and the other on the east face of the tank. The letters have a maximum height of 16 feet and the words are each 25 feet long. The top of each of these signs is 30 feet above the roof, and the words are composed of 15-watt Mazda lamps set in white-enameled frame with red outline on the outside of the letters.

There are 344 lamps in the letter "F," 135 in "or" and 105 in "d," making a total of 584 in each word. The lamps are all white and non-flashing.

The company has on hand two sets of the alphabet and two sets of figures in three-foot interchangeable illuminated metal letters, which are hung in place on the lower panel of the principal sign by means of hooks, and the electrical connection obtained through plugged-in cords.

Tests gave an energy consumption of 20,043 watts for the large flashing sign, and 15,594 watts for the two tank signs, a total of 35,637 watts. The lamps are operated at 115 volts, on Cambridge Electric Light Company service.

Ohio New-Business Meeting.

The fifth convention of the Committee on New Business Co-operations of the Ohio Electric Light Association was held at the Virginia Hotel, Columbus, O., on Wednesday, May 19, with approximately 60 delegates in attendance.

The chairman of the committee, Thomas F. Kelly, commercial manager of the Dayton Power and Light Company, opened the meeting at 10 o'clock and introduced S. G. McMeen, president of the Columbus Railway, Power and Light Company. Mr. McMeen, in addition to welcoming the delegates to Columbus, gave a very interesting talk on the benefits to be secured by such meetings as have been held during the past ten months throughout Ohio by this committee.

The first paper presented was by L. T. Milner, manager of the Cincinnati office of the Western Electric Company, on "Value of Show-Window Advertising." This paper was discussed by a large number of the delegates, and many told of the results they had secured with good timely displays and well lighted windows.

D. L. Gaskill, the secretary of the Association, in his remarks said he believed every electric light and power company, no matter how small, owed it to the community in which it was operating to see that its windows were kept properly dressed with timely displays, and that its windows and the windows of the merchants in the village, town or city, were properly illuminated. During the discussion attention was drawn to the co-operation that is now being offered operating companies by manufacturers of electrical apparatus of all description and by the Society for Electrical Development, in securing seasonable window displays.

Following the luncheon held at the noon hour in the Rose dining room of the hotel, A. C. Seymour, president of the Columbus Chamber of Commerce, delivered a very entertaining and interesting address on "Service First."

The afternoon session started at 2 o'clock, when Kenneth McKinley, the efficiency engineer of the Civil Service Commission of the State of Ohio, delivered an inspiring talk on "Efficiency in Selling."

V. L. Blanchard, of the Toledo Railway & Light Company, presented the next paper on "Electrical Advertising." Mr. Blanchard, in answer to questions, stated that in Toledo, if necessary, the purchaser of the sign was allowed to pay for same in monthly installments, after the company had satisfied itself as to his credit. Of the 504 electric signs sold in 1914 only 15 had not been paid for in full by the original purchaser, but as these signs had read "Drugs," "Cigars," etc., they had been sold to other sign purchasers after re-painting. Electric signs are sold in Toledo by the salesmen of the Toledo Railway and Light Company. The company pays the sign manufacturer upon delivery of sign and collects from the customer.

Following the presentation of this paper the meeting was given over to a round table discussion of different topics of interest to the delegates.

In closing the meeting, Chairman Kelly, on behalf of his committee, thanked those present for the co-operation that had been given the committee throughout the year, and asked that the same interest would be given the meetings to be held following the summer vacation.

On Thursday, May 20, the committee met in Columbus and prepared its report for presentation at the annual convention of the Association, to be held at Cedar Point in July.

The Electrification of Mills at Bombay.

Large mill electrification operations are in progress at Bombay, India. The problem presented by the Bombay mills is the conversion of mechanical to electrical drive utilizing the present shafting, the change being effected with as little interference as possible with the production of the mills. The problem was thoroughly investigated and as a result group-driving with direct-coupled motors was adopted as being best suited to the requirements of the Bombay industry. Standard speeds of 265, 290 and 365 revolutions per minute were adopted. The motors are of the slip-ring induction type wound for 2,000 volts, three-phase, 50 periods and provided with brush-lifting and short-circuiting gear, and are in standard sizes ranging from 30 to 500 horsepower.

The starting switches are of the liquid type, the electrodes being operated through slow-motion gear and the motors being designed to start up against the full-load torque with a starting current not exceeding the full-load current. In the case of callender machines special starters are required.

A substation is provided at each mill for the transformers and switchgear, the feeders being connected up to the high-tension busbars through trifurcating boxes, single-conductor cables, a triple-pole oil emergency switch, and disconnecting links. The high-tension sides of the transformer circuits are connected to the busbars through similar disconnecting links, and the low-tension sides to the low-tension busbars through disconnecting links. The motor circuits are run from the low-tension busbars as three-core paper-insulated, lead-covered and armored cables to the switch pillars, and single-conductor cables of a similar type are run from pillars to motors.

The present electrification contract covers 30 mills, requiring 63 transformers aggregating 39,500 kilovolt-amperes and 199 motors aggregating 37,525 horsepower, the power requirments of individual mills ranging from three motors aggregating 325 horsepower to 19 motors totalling 2,400 horsepower.

All the mill engines were indicated for maximum and average indicated horsepower and tachograph tests were made of the loads on the shafts, the steam-driven rope drivers being replaced by direct-coupled motors which are installed in most instances in the rope races, on stagings built up of rolled-steel joists, the motor feet being fastened to the steel work by means of foundation bolts. In certain cases the motors are placed on steel-tower structures outside the building and are roofed in.

Energy for lighting is supplied at 2.5 cents per kilowatt-hour and for power at 1.1 cents per kilowatt-hour.

Electrical Construction

Among the Contractors.

The Kansas State Board of Administration let to E. A. Brown & Company, Kansas City, Kans., the contract for wiring the new memorial hospital at Rosedale, and the contract for rewiring the state school for the blind in Kansas City, Kans.

Lee & Osborn, electrical contractors and dealers, of Salem, Mass., have moved their store and office from 74 Washington Street to 201 Washington Street, where they occupy large new quarters adjoining those of the Salem Electric Lighting Company.

G. G. Burkholder Electrical Construction Company, of Kansas City, Mo., has moved from 11 East Eighteenth Street to 407 East Fifteenth Street. The company had the contract for the wiring of the new Muehlebach Hotel; in order to complete that contract the company signed up with the union, and is the only one of the contracting companies, it is said, which did so sign. The contract, however, is only for the completion of the Muehlebach work.

ELECTRIC ELEVATORS, OPERATION AND MAINTENANCE.—II.

By A. C. Bender.

Instructions for the Care and Operation of Electric Elevators.

Open the main line switch when preparing to clean, oil or repair any part of the machinery. Keep all parts of the machine and controller scrupulously clean; a pair of hand bellows should be used to blow the dust from the armature and fields and other parts of the apparatus that cannot be conveniently reached. All other parts must be wiped clean.

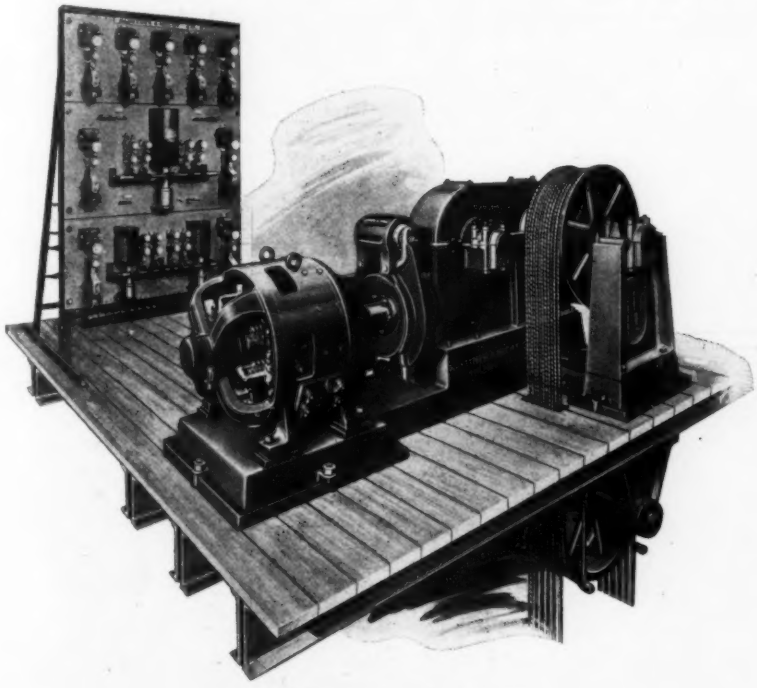


Fig. 9.—Worm-Gear Traction Elevator.

Cleaning and Oiling.—Oil the worm and gear with worm-gear lubricant. Always keep the chamber filled to top of worm. To remove sediment and grit, drain the oil from the gear case and flush with kerosene three or four times a year. Refill the case with fresh oil.

The worm shaft bearings are automatically oiled from worm chamber, and oil should be allowed to drip slowly through the worm-shaft gland to insure perfect lubrication of the bearings. Use drip cup to catch the oil.

The worm shaft must be kept packed with soft square braided-flax packing.

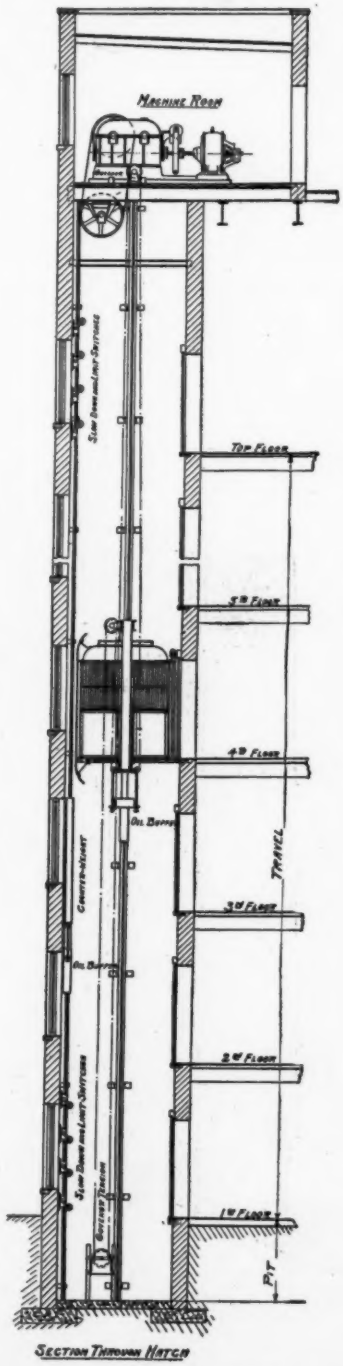


Fig. 10.—Machine Installed.

The gland adjusting nut must be tightened evenly to prevent binding worm shaft. Oil drum-shaft bearing every day; oil armature bearings with bearing oil. The bearings have automatic feed rings, and the oil chamber must be kept sufficiently full of oil to insure the oil rings dipping into it; always keep the oil a little below the bottom of the shaft to prevent flowing into the commutator and motor windings.

To prevent sparking at the commutator, when adjusting or renewing the brushes, grind them to a full bearing with a strip of fine sandpaper. This may be done by placing the paper between the commutator and carbons (sand side against carbons) and drawing the sandpaper back and forth by hand.

The carbon must always project beyond the holder so that holder does not bear on the commutator. The brush springs must be sufficiently strong to insure good contact, but no tighter. In case the commutator should become rough it may be smoothed by holding a piece of fine sandpaper against the surface while the machine is running. After which it should be wiped clean. A cloth pad should always be used for cleaning the commutator; do not use waste.

Adjust the brake spring to properly hold load. Set brake shoes to just clear

Fig. 11.—Direct-Traction One-to-One Machine.

pulley when released. The brake pulley and brake shoes must be kept dry and clean. When necessary to remove the brake shoes for cleaning or repairs, the empty car should be left at the upper landing and the main line switch open. Set the stop collar on the automatic stop screw so car will stop at upper landing with normal load and level with lower landing when empty. The car should be frequently tried on automatic stop to see if collars are properly adjusted, as the automatic may be thrown out of adjustment by stretching of the cables. Remove cover from automatic switch on machine frequently and clean contacts, removing all dust or grit between contacts and from case.

Contacts of slack-cable switch should be examined and cleaned frequently to prevent dirt or grit getting on them and breaking contact. This also applies to the limit switches in hatchway.

Lubricate vibrator sheaves with compression cup grease. Keep metal and carbon contacts on controller clean and free from pits or blisters. They should be frequently smoothed with sandpaper and have good even bearing when in contact. Springs should also be adjusted to obtain this result. Plungers of magnets should be bright and smooth and should be tried by hand to make sure they do not stick. Oil sparingly the pins and moving parts of the different switches and see that all cotter pins are in place.

The cover of the car switch should be removed weekly to see that contacts are in good condition and properly lubricated. Keep all parts of switch clean to prevent dirt accumulating and causing short-circuits. The cables should occasionally be coated with cable preservative to prevent rusting. This may conveniently be applied with a brush. All the safety devices on the car frame and car should be examined at frequent intervals, and

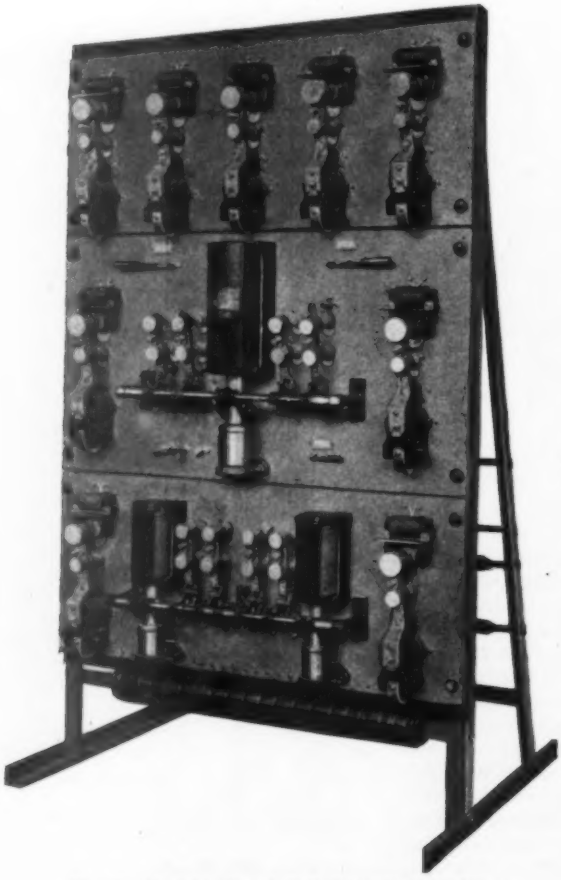


Fig. 12.—Variable-Speed Full Magnet Controller.

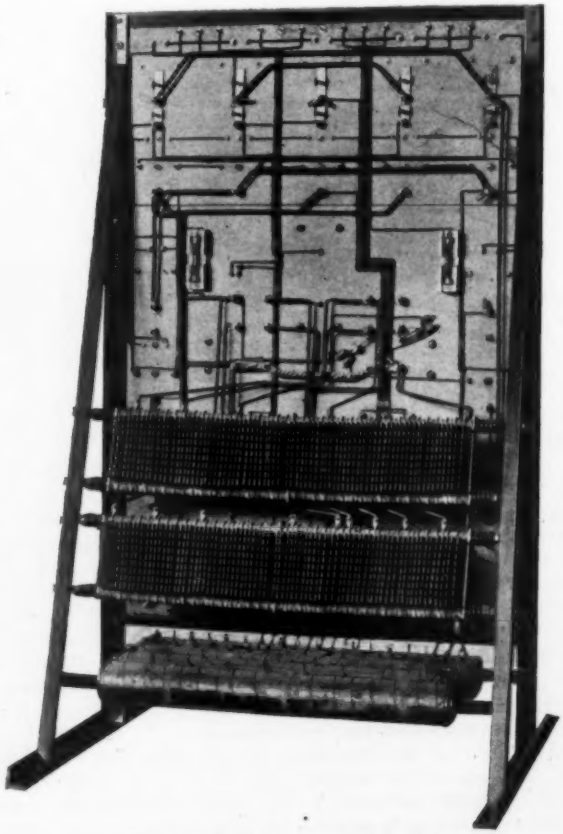


Fig. 13.—Rear View of Same Panel.

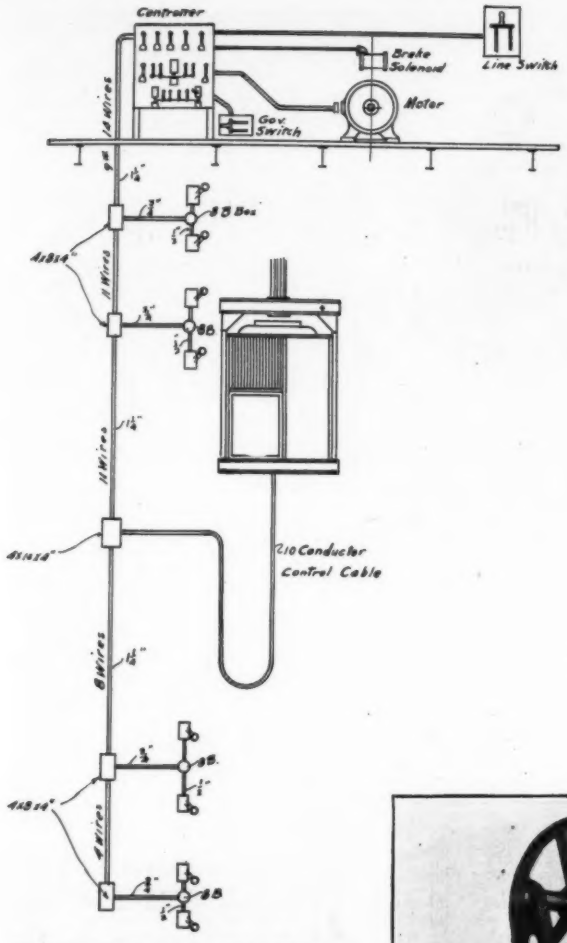


Fig. 14.—Wiring for Three-Speed Traction Elevator.

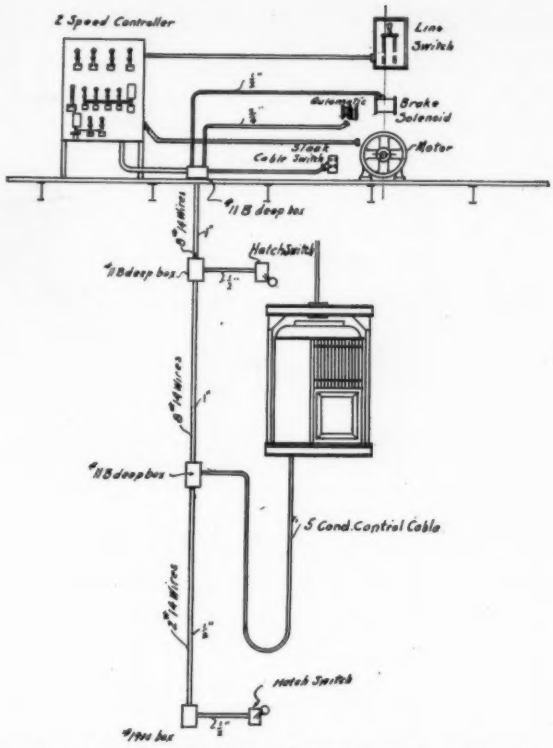


Fig. 16.—Wiring for Full-Magnet-Control Drum-Type Elevator.

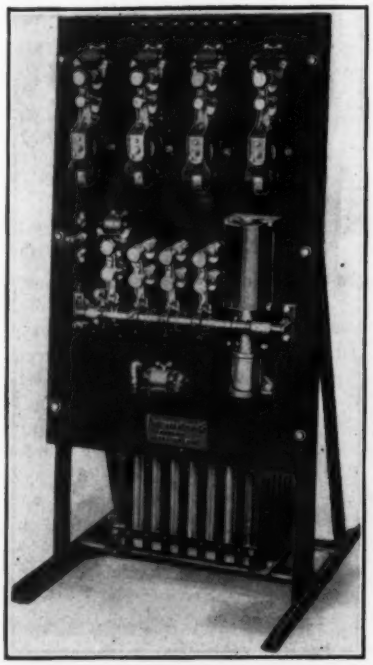


Fig. 15.—Single-Speed Full-Magnet Controller.

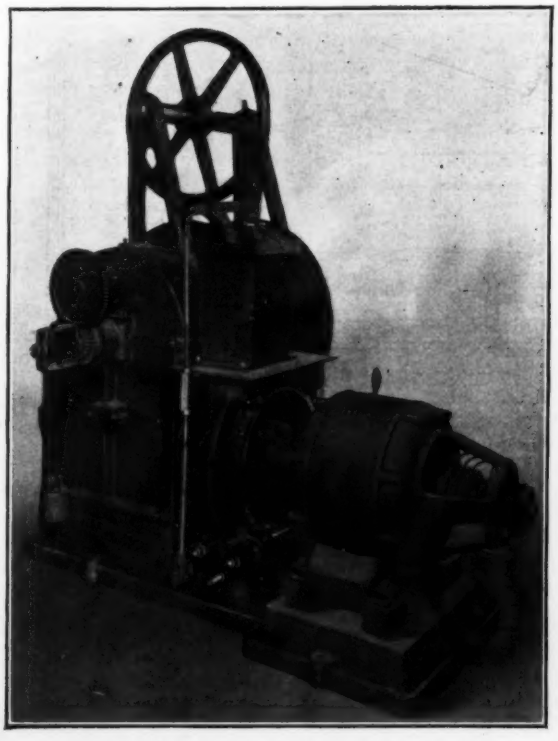


Fig. 17.—Alternating-Current Drum-Type Machine.

all working parts be kept lubricated and free from rust.

Keep boxes of overhead sheaves packed with compression cup grease. Be sure that grease reaches the shaft. For guides use guide lubricant.

The governor bearing and main stem must be lubricated frequently.

Operation.—To start the car, move car switch lever half way down, in which position up or down magnets on controller will make contact and the accelerating magnets automatically cut out armature resistance as the speed of motor increases. The accelerating magnets should be set to act consecutively, at equal intervals, and under normal load will all operate within three or four seconds, if properly adjusted.

To stop the elevator, move car switch lever to slow speed when car is about three feet from landing, and finally to center to stop car at landing. Always keep car switch in the central position when elevator is out of service. Replace centering spring when worn or broken. If elevator fails to start from car switch, look for open circuit at potential-switch, fuses and small fuses on controller, also controller con-

tacts, slack-cable switch, automatic-stop switch or limit switches.

If elevator refuses to lift normal load, examine the machine bearings, gear and thrust to see if they are dry or hot from lack of oil, also see if controller makes good contacts. If car should stop suddenly when descending, throw lever to center, then examine machine and make sure that ropes are in proper grooves on drum. Inspect safety clutches, and if they have operated, determine the cause and have them properly released, after cables have been tightened. If elevator should fail to stop when the car switch is in stop position, open safety switch, and if this fails to stop the car let it travel to top or bottom of the shaft as the case may be, where it will be stopped by the automatic devices. Then examine the machinery and locate cause of trouble. Automatic devices must be kept in adjustment, lubricated and clean.

Never attempt to leave the car while it is in motion. Stop car at top and bottom landing by the car switch, same as at intermediate floors. When possible have the attendant who is to operate or look after the elevator keep in touch with the foreman of erection while the elevator is being installed. On completion, the foreman will gladly go over all the parts with the attendant and instruct him as to their adjustments, use and the care required to keep them in proper working condition. By having a careful attendant become familiar with the apparatus in this practical way, the best results can be obtained and the greatest freedom from repairs assured. When ordering repairs for elevators, mention the number of machine as stamped on large name plate, also give parts number and name as shown in regular catalog, and when possible give name of original purchasers.

Drum Worm-Gear Elevators.

Essentially all electric elevators are similar in many respects, and derive names as traction, worm-gear, friction, etc., from the method and nature of transmission from the motor to the drum.

Broadly speaking, they are all electric elevators if the power is supplied by electric motor. The principal transmission used on electric elevators is the worm gear, and it is regarded highly efficient.

We must for briefness omit a great number of electric machines, and describe only the worm-gear type as used for passenger and freight, with full magnet control, with controller box in the car, and the automatic elevator controlled with push-buttons by the passenger.

What was said about traction elevators in respect to testing, maintaining, and other attentions will apply in a large measure to any type of machine, and should require no repetition.

A good view of a worm-gear traction elevator is shown in Fig. 9. This is a Kaestner & Hecht machine, and shows the general arrangement of the secondary sheave, controller board, etc. Fig. 10 is a hatch section of this machine, when installed. The one-to-one direct engine is shown in Fig. 11. The front view of the variable-speed full magnet controller is shown in Fig. 12 and the rear view in Fig. 13.

Fig. 14 is a conduit and wiring layout for a traction machine.

The motor used on Otis direct-current elevator is generally an Eickemeyer type bipolar compound machine with drum-wound armature. In this motor the series coil is cut out after the motor is up to speed. Kaestner & Hecht Company uses a special Westinghouse compound motor.

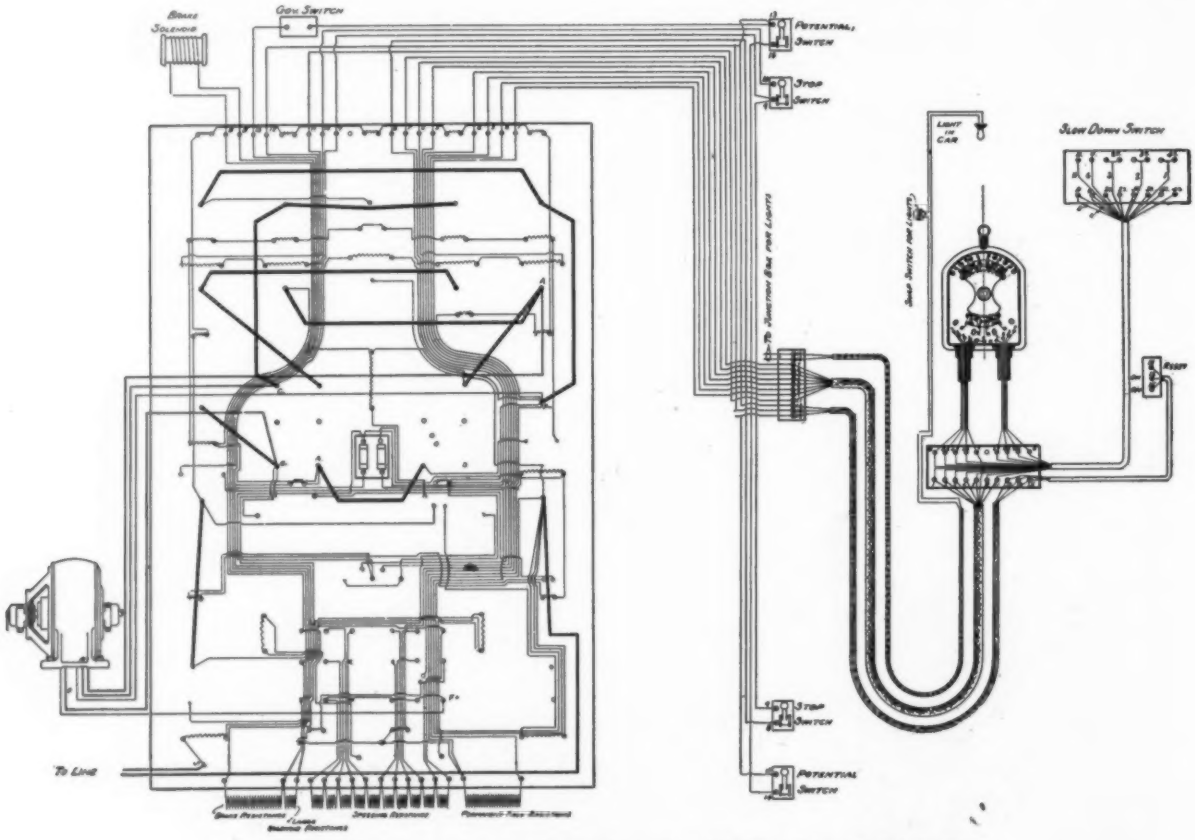


Fig. 18.—Wiring Diagram for Four-Speed Controller with Slow-Down Switch in Car.

Transmission.—The transmission is a single or tandem worm gear with suitable bearings and housing for containing the oil. As with the traction machine buffers are used between the drum and worm gear to reduce vibration.

On some types back gearing is provided that can be used to reduce the speed and increase the lifting power when extra heavy loads are raised or lowered.

Brakes.—The brakes on this type of

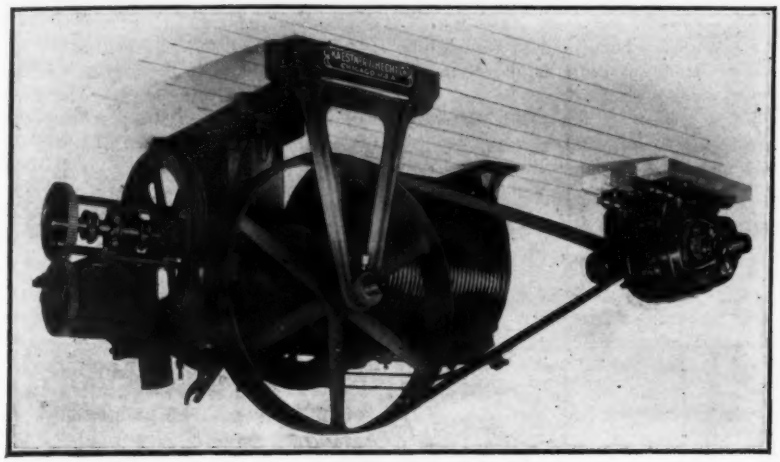


Fig. 19.—Elevator Belted to Motor.

machine are released by an electric solenoid and applied by coil springs. A steel brake-band faced with leather is used on the coupling pulley.

When alternating current is used the mechanical design is not altered appreciably. The motor used is either a polyphase synchronous or induction type, as single-phase motors are not self-starting on heavy loads and therefore cannot be used.

Fig. 17 is a Kaestner & Hecht alternating-current drum-type machine and controller. Fig. 16 is wiring layout for this type of machine.

Fig. 15 represents a single-speed full-magnet controller for freight and medium-speed passenger service.

For warehouse and garage buildings, belt-driven machines are often used for short lifts. Fig. 19 shows a machine of this type.

Fig. 20 is a drum-type direct-current elevator, and Fig. 18 the wiring diagram for controller used with this type of machine, showing the back of the board.

(To be continued.)

Practical Notes on Rotary Converters.

Rotary converters are now employed very extensively, not only in public supply stations and substations, but also in industrial applications, to convert alternating to continuous current. As compared with motor-generators, rotaries offer the advantages of higher efficiency, better commutation, higher overload capacity and lower first cost. On the other hand, the motor-generator is more flexible in respect of voltage regulation.

Rotary converters operate satisfactorily in all frequencies. If direct-current supply be available, the converter can be started from the direct-current side. Starting from the alternating-current side is practicable only in small machines; the converter then drags itself up to speed as an induction motor. Generally, starting is effected by a slip-ring or squirrel-cage induction motor mounted on an extension of the converter shaft. Usually rotaries have to be synchronized with the alternating-current supply, but there is a patented, self-synchronizing starting system. The converter is run up to speed by an auxiliary machine and switched on to the alternating-current supply, with series resistance between the transformers and slip rings. The converter pulls into step, invariably with correct polarity, and the resistance is then cut out.

The direct voltage obtainable from a rotary depends upon the maximum value of the alternating pressure wave and can only be increased by increasing the latter. Changing the field excitation merely changes the power-factor of the machine. Up to 10 per cent voltage, regulation can be obtained by using transformers of fairly high reactance to supply the converter. The inductance voltage of the transformer adds itself to the terminal voltage when the current is leading, and subtracts itself when the current lags. By regulating the converter field and hence the alternating-current power-factor, the voltage on the alternating-current slip rings can be varied conveniently over a 10-per-cent range on this system, but for wider pressure regulation, it is necessary to use an alternating-current booster which adds or subtracts its electromotive force to or from the transformer voltage.

To a great extent, the alternating and continuous-current components "cancel out" in a rotary-converter armature, and it is due to the less total heating that the overload capacity is greater and the efficiency higher than in the case of a motor-generator. Since the armature reaction is practically zero, commutation is excellent. The heating in a converter winding is not uniform, but local heating is reduced, and efficiency and output are increased by winding a three-phase converter for the six-phase supply, which can be obtained from the transformers at no extra cost.

Practically all three-phase converters are now wound six-phase, the necessary voltage connections being derived from a single or double set of secondaries.

No star connections may be used on the primary side of transformers supplying rotary converters unless the secondary be delta-connected or the neutral of the primary be connected to that of the generator. Otherwise trouble is caused by triple harmonics.—*Electricity.*

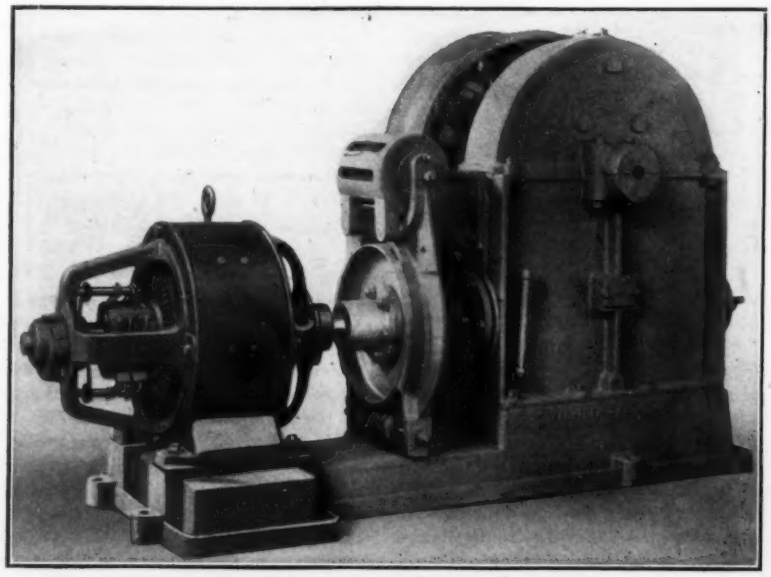


Fig. 20.—Drum-Type Direct-Current Elevator.

Illinois Contractors' Meeting.

The semi-annual meeting of the Electrical Contractors' Association of the State of Illinois will be held at Peoria, June 17 to 20.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Marking Tools.

While trying to find some effective way of marking my tools, I tried the following scheme and it worked satisfactorily. I connected one side of a 110-volt circuit to one terminal of a toaster, joined the other terminal of the toaster to the metal of the tool to be marked, fastened a piece of lead from an old lead pencil to one end of a piece of wire and connected it to the other side of the live circuit. By lightly tracing my initials on the tool with the lead an indelible and clearly legible identification mark was left.

Oscar Sorenson.

Adjustable Charging Plug.

I find that a convenient way to put away a charging plug which hangs from the ceiling is to run one-half-inch pipe along the ceiling and down the wall into a piece of one-inch pipe, as shown in the diagram below.

Fish a piece of one-eighth-inch steel wire rope into the pipe, with plenty of grease on it. On one end of this rope fasten the cable of the plug, and on the other end, a weight equal to the weight of the plug. The length of the one-inch pipe is equal to the distance the plug travels. The rope should be long enough to enable the plug to hang a full length with the weight against the end of the one-half-inch pipe.

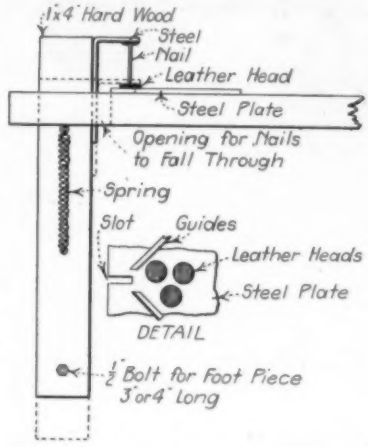
The plug can then be thrown up out of the way easily. A pole with a blunt hook on the end is used to pull the plug down.

Edward Kemp.

Leather Heads on Nails.

I use a very handy device for putting leather heads on nails, as shown in the accompanying illustration.

I take a piece of 1-by-4-inch hardwood to which I securely fasten a strip of steel 0.75 inch wide and thick enough so that it will not bend easily, and bend it as shown, leaving the projection about 2.5 inches long. The wood piece is so attached to the bench that it will work freely up and down, but with very little play. Through the bottom is put a one-half-inch bolt, letting it extend outward 3 or 4 inches for a foot piece. A spring is then so attached that it will keep the wood piece in the "up" position, which must be far enough above the bench to insert the nail under the steel projection, as shown. Next take a steel plate and cut a slot, about 0.75 inch long and wide enough for the nail to work freely, in one side of the plate and fasten the slot directly under the steel projection on the 1-by-4-inch wood piece, with the open end of the slot toward the wood piece, but far enough away for the nail with the leather head upon it to fall through. Put guides on either sides of the slot to bring the leather heads into correct position over the slot.



Device for Putting Leather Heads on Nails.

To operate, simply place the point of the nail in the hole in the leather head and slip it over the slot and under the steel projection, place the foot on the bolt projection and press down. The next nail will always push the preceding one out of the slot into the keg or box fixed to catch the nails after they are headed. Dotted lines show "down" position.

W. H. Best.

Lead Washers on Nails.

I have been using lead roofing washers on nails to fasten porcelain knobs and cleats with and they work very well. They can be put on much more quickly than the leather heads, and I have found that they answer the purpose fully as well. For the cleats I use eight-penny nails and for the knobs ten-penny nails. The washers can be obtained from any dealer handling galvanized roofing and they cost about 12 cents a pound. It is better to put two washers on each nail.

W. C. Branning.

Compartment Box.

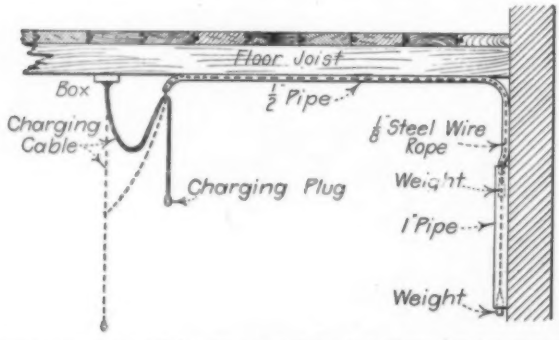
The accompanying diagram is of particular value to fixture men or repair men who find it necessary to carry different sizes of screws, nails, bushings, nipples, etc., in their tool box and want to have them segregated so it will not be necessary to empty the box in order to find the fitting wanted.

Use a length of tin downspout of say two inches in diameter and 24 inches in length, or any other size depending on receptacle wanted. Cut the spout in two pieces of twelve inches each; cut the seam and one-fourth of circumference from one part and roll it smaller so that it will slide freely within the other part. Cut, say, eight disks of metal whose diameter is that of inside of uncut length less twice the thickness of metal.

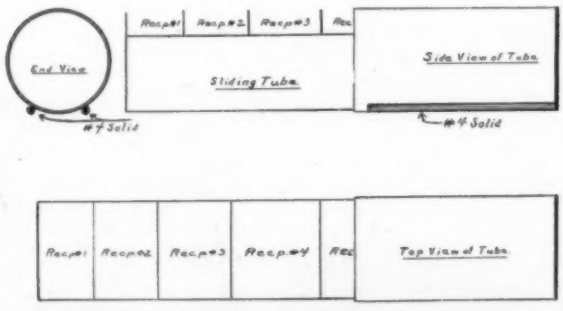
Solder disks on cut length, one at each end, with remainder spaced between at desired distance. This arrangement will give seven receptacles.

Solder two pieces of wire, No. 4 solid, lengthways on outside tube so that wires support tube to prevent its rolling.

Robert Oster.



Arrangement for Lifting Charging Plug Out of Way When Not in Use.



Construction of Compartment Box for Carrying Screws, Nails, Bushings, Etc.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

United Railroads of San Francisco. On May 18 the Commission rendered a decision upon the investigation of the financial affairs of the United Railroads of San Francisco.

As a result of its investigation the Commission orders that the company set aside the sum of $550,000 annually for a period of three years, to be used for the purpose of bettering and improving the street railway system and service in San Francisco. It is provided in the Commission's order that of this sum $250,000 may be spent annually by the company as it may deem necessary for the upbuilding of the properties, and the balance of $300,000 per year should be used for additional facilities, extensions, for the improvement of service or for the fulfilling of franchise obligations, but the expenditure of this $300,000 fund shall be under the supervision of the Commission.

The Commission traced the $1,096,000 which Mr. Calhoun was permitted to withdraw from the funds of the United Railroads, and which it was stated had been invested in the Solano Farms Project. The Commission finds that apparently all of this sum, with the exception of $207,588, went into the Solano Farms Project. The Commission says: "This sum of $207,588 remains unaccounted for."

In commenting upon the fact that $1,096,000 was taken from the funds of the railway, the Commission says: "In the absence of such a restitution or the presentation of a plan which would bring about the restoration of the funds, this Commission will not look with favor upon any disbursement of this company in the form of dividends to its stockholders."

INDIANA.

The Noblesville Light and Power Company was granted the right to purchase the plant of the Cicero Light and Power Company for $7,500. The appraised value of the Cicero plant, exclusive of any going value, was put by the Commission at $5,408.64.

KANSAS.

Court Case. The Supreme Court of Kansas has issued an order dissolving the Shawnee County Court injunction against the decision of the Public Utilities Commission, which reduced rates on coal from the Pittsburg district to Salina. The court ruled that when the Commission orders a lower rate, the burden is upon the subject company to prove that the rate is confiscatory, and further stated that the orders of the Commission are not to be interfered with by the courts, unless there is strong ground for believing that injustice is being done.

NEW HAMPSHIRE.

The New England Telephone and Telegraph Company has filed with the Public Service Commission a schedule of short-term telephone rates in accordance with the provisions of an act passed at the last legislative session. This act repealed the short-term telephone-rate statute of 1909, but provided that every telephone company in the state should establish rates for terms of 3 to 11 months, such rates to be subject to the jurisdiction of the Commission and open to investigation and revision, upon petition, the same as other utility rates.

Under the New England schedule filed, the rate for any term less than a year is made a proportionate part of the yearly rate, plus an "adjustment charge," so termed, the adjustment charge being made to diminish from month to month till the end of the eleventh month. If the service continues 12 months the charge entirely disappears and the annual rate applies.

The adjustment charge varies according to the exchange of the subscriber. Under the standard charge $11 is added to the proportion of the yearly rate in the case of service for one month, and this addition diminishes at the rate of $1 per month, becoming only $1 in the case of an 11 months' term.

Upon all exchanges in the state, however, except summer exchanges, a lower charge is allowed to subscribers within a radius of one mile from the exchange. The company proposes to put the new rates in effect June 12, 1915.

PENNSYLVANIA.

Commissioners Appointed. Governor Brumbaugh requested that all appointments made by his predecessor during the recess of the Senate be returned to him, and the request was complied with. The original appointments to the Public Service Commission were among the ones affected. The Governor made appointments to this Commission, retaining only two of the original members, and these appointments have been confirmed by the Senate. Samuel W. Pennypacker and M. J. Brecht have been retained for terms of ten and seven years, respectively. The new members are John S. Rilling, nine-year term; William A. Magee, eight-year term; John Monaghan, six-year term; Edgar A. Kiess, five-year term, and William D. B. Ainey, four-year term.

Telephone Pioneers to Meet in San Francisco.

The fifth annual meeting of the Telephone Pioneers of America will be held in San Francisco, Cal., on September 21 to 23. The headquarters of the organization will be at the St. Francis Hotel, where a business meeting will be held on the morning of the first day, and papers will be presented in the afternoon. In the evening of that day a banquet will be tendered the Pioneers by the American Telephone & Telegraph Company. On the second day the Pacific Telephone & Telegraph Company will take the members and their friends to Sausalio and Mt. Tamalpais. The third day will be devoted to a reunion at the exhibit of the American Telephone & Telegraph Company at the Panama-Pacific Exposion, at which time demonstrations of transcontinental telephony will be made, in which all present will be invited to participate.

A special Telephone Pioneers' limited train is being arranged for to take members and their friends from the East to the convention city. This train will leave New York City on September 14, making stops at Chicago, Omaha, Denver, Colorado Springs and Salt Lake City, arriving at San Francisco on September 20. One week will be devoted to the Pioneer reunion and visits to the exposition. Leaving San Francisco on September 26, a trip will be made along the shore to Los Angeles and San Diego; on the return trip stops will be made at the Grand Canyon in Arizonia and at Kansas City. Arrangements are in charge of R. H. Starrett, secretary, 15 Dey Street, New York City.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 281.—Maximum Demand of Residences.—In central-station systems using the two-rate system for residence customers it is customary to charge at the primary rate for the first 30 or 60 hours' use of the maximum demand. Since the cost of providing a maximum-demand indicator for each small customer is prohibitory, in view of the already heavy cost of watt-hour meters, what is the simplest and most equitable way of estimating the probable maximum demand?—E. C. R., Chicago, Ill.

No. 283.—"Jitney" Bus Regulation.—Have any of the public utilities commissions in the United States taken action to regulate the operation of "jitney" autos with the idea of protecting the safety of the public and the investments of security holders in regularly enfranchised street-railway companies?—T. M., Winnipeg, Man., Canada.

No. 284.—Visual Indicator.—A physcian, who has a public reception room always kept open adjoining his closed private office, wished to have arranged some kind of automatic electric indicator to show him when some one entered the reception room, this to be done preferably by a small lamp lighting up or some other visual means instead of a bell or buzzer that would disturb the patient in his private office. Is it possible to rig up something of this kind operated by stepping on the threshold of the reception room that would be passed by an electrical inspector?—W. C. N., Toledo, O.

No. 285.—Motor Peculiarity.—A one-half-horsepower direct-current motor operating a small ceiling hoist was overhauled and cleaned recently and after starting up again we noticed that it started jerky and seemed to run faster with a large load than with a small load. On examining it again, the electrician swore he had both the fields and armature connected up as originally, but it still operates in this peculiar way. What is the cause of this? How can it be remedied?—S. P. A., Philadelphia, Pa.

No. 286.—Static in Press Room.—In the press room of a large printing establishment much trouble was experienced during the driest part of last winter from static electricity causing paper sheets to stick. Attempts were made to take the static from the driving belts, but without entirely relieving the trouble. A suggestion was made that a humidifying apparatus be put in to keep the air more moist, it being claimed this would immediately stop the trouble. Is this a reliable solution? If not, what is the best way to get rid of the static?—C. A. C., Omaha, Nebr.

Answers.

No. 280.—Closed-Circuit Burglar Alarm.—A garage situated in the rear of a large residence is to be provided with a burglar alarm of the closed-circuit type to prevent cutting or tampering of the wires. What kind of battery is best suited and cheapest to use on this circuit?—A. T., Evanston, Ill.

It appears to me that the inquirer shows plainly he has not previously installed such an alarm or had any experience with a strictly safe and reliable closed-circuit alarm outfit. To go to the expense of putting in any system that does not give perfectly safe protection is foolish. First there will be needed a main-line or closed-circuit battery at the garage; this may be of the crowfoot, bluestone or telegraph type or the alkaline copper-oxide type. Any open-circuit battery (such as dry cells) will answer at the house end of the line for the secondary side of the polarized relay to operate the bell, which should be of the continuous-ringing type.

I would advise the party to place the installation in the hands of a reliable contractor, who will give him a strictly first-class job and also, a most important point, a guarantee that it cannot be beaten. Otherwise, of what good will such an outfit prove if it can be opened by one familiar with such systems? A reliable system cannot be installed by a novice. Such a system will cost but little more than a cheap, undependable outfit. The garage can be so protected that there is scarcely one chance in a thousand that anyone but the one who installed the equipment could enter without setting off the alarm.—F. F. H., Milwaukee, Wis.

No. 282.—Universal Motors.—What is the relative efficiency of the best makes of small universal motors (say, one-eighth horsepower), that can be used on both direct-current and single-phase circuits, compared with the best makes of direct-current motors and alternating-current motors of the same size? How do they compare in first cost, maintenance cost and general performance?—H. F. S., Peekskill, N. Y.

Before the question of efficiency can be considered the type of design must be taken into consideration. On small motors, such as the eight-inch universal fan motor, there is no change in connections when changing from alternating current to direct current. The motor has a series field of few turns. The field punchings and the armature slots are given an axial twist in order that the machine on alternating current will have the required starting moment. This type of motor usually has one field coil per pole, (see type A in the table).

For speed devices requiring high starting torque, such as for operating a centrifuge, it is usual to use a bipolar series motor wound in one of several different ways. Two coils may be wound in parallel, one for alternating-current operation and the other for direct-current operation, and placed on one field pole. In this case in changing from alternating current to direct current it is only necessary to change coil connection from one top to the other. The dead coil is left open-circuited at the terminal board (see type B in table).

Where it is necessary to cut down the shop assembly cost the two coils are wound in parallel and slipped on the field punchings so as to span the two poles and are tied there with wire. This method is open to the objection of excessive leakage flux, but is tolerated in this kind of work (see type C in table).

Type	Relative Maintenance Cost	Relative Shop Del. Cost	Relative Efficiency	Actual Efficiency
A	1.00	1.00	0.87	0.65
B	1.00 A. C. 1.10 D. C.	0.95	0.73	0.55
C	1.00 A. C. 1.10 D. C.	0.55	0.67	0.50
D	1.00	1.00	1.00	0.75

In the accompanying table comparative data of the three types of universal motors are given. Each of these is one-eighth horsepower in rating. Type D is a direct-current motor wound with one field coil per pole and is merely given as a standard of comparison.—H. E. W., Chicago, Ill.

Theaters Install Call Signals for Firemen.

A ruby lamp, to summon to a fire any call firemen who may be in the audience, is a novel device lately introduced in two theaters at Salem, Mass. The fine of one dollar for absence from a fire has deterred many call men from attending the theater, as the alarms could not be heard when a performance was going on; but the enterprising proprietor of the Federal and Salem theaters devised the scheme of a red signal lamp, operated by the stage manager from his place at the back of the stage, in hearing of the alarm whistle.

The lamps are installed in the front of the stage, at the right of the orchestra leader's position. When a public alarm is sounded, the stage manager switches on the light, which is a 25-watt red-dipped tungsten, and it is allowed to remain lighted 7 or 8 minutes.

The public, as well as the firemen, have been made acquainted with the meaning of the signal, so no confusion or alarm ensues when the light is turned on. The two theaters are the leading playhouses in the city, seating 1,500 and 1,300, respectively.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 38.

A lead-covered single-conductor cable is made of a No. 4 copper wire surrounded by a layer of rubber 0.25 inch thick, which is in turn surrounded by a lead sheath. The specific inductive capacity of the rubber is 3.5. (*a*) What is the electrostatic capacity of this cable per mile? (*b*) If a direct emf. of 10,000 volts is impressed between the wire and the sheath and the resistance of the rubber is assumed infinite, what is the potential drop between the copper wire and a point in the rubber 0.01 inch from the wire? (*c*) Under the conditions of Question (*b*) what is the potential drop between the lead sheath and a point in the rubber 0.01 inch from the sheath? (*d*) Under the conditions of Question (*b*) what is the potential drop between the copper wire and a point midway between the wire and the sheath? (*e*) If a layer of guttapercha (specific inductive capacity equals 4.5) is substituted for the outer half of the rubber, giving an insulation consisting of an inner layer of rubber (0.125 inch thick) surrounded by a layer of guttapercha (0.125 inch thick), what is the potential drop in the rubber and the guttapercha when a direct emf. of 10,000 volts is impressed between the wire and the sheath?

SOLUTION OF PROBLEM 38.

The capacity of a condenser consisting of an insulated wire inclosed in a metallic sheath is given by

[52] $C=0.0388K/(\log r_2/r_1)$ microfarads per mile, where K is the specific inductive capacity of the insulating material, r_1 is the inner and r_2 is the outer radius of the insulating material. Since the radii appear in the formula as a ratio, any unit of measurement may be adopted so long as each radius is expressed in the same unit.

Answer to Question a.

The diameter of a No. 4 wire is 0.204 inch and the radius 0.102 inch. The outer radius of the insulation therefore equals 0.102+0.250 or 0.352 inch. Substituting these values of r_1 and r_2 in [52] we have

$C=0.0388\times3.5/(\log 0.352/0.102)$
$=0.136/\log 3.45=0.253$ microfarads per mile.

Answer to Question b.

To facilitate analysis a thin cylindrical metallic shell may be inserted anywhere in the rubber insulation without changing the electrical conditions within the cable. If the rubber insulation is thus subdivided by a metallic surface the cable will then contain two condensers connected in series.

The combined capacity (C_o) of any number of series condensers of capacity C_1, C_2, C_3, etc., respectively, is given by

[53] $1/C_o=1/C_1+1/C_2+1/C_3$, etc.

If there are but two condensers connected in series, [53] reduces to

[54] $C_o=C_1C_2/(C_1+C_2)$

Since the positive and negative charges in any number of condensers connected in series are equal and since by [48] $Q=CV$ in each condenser, the product of capacity and voltage in each condenser must be the same, or $C_1V_1=C_2V_2=C_3V_3$. The relation between capacity and voltage for two series condensers is then given by

[55] $V_1/V_2=C_2/C_1$

or the potential differences are in inverse proportion to the capacities. If the combined capacity of the two condensers is C_o and the total potential drop in the condensers is V_o the voltage across one of the condensers is given by

[56] $V_1=C_oV_o/C_1$ volts.

If a thin cylindrical metallic shell is imagined to be inserted in the rubber insulation at a distance of 0.01 inch from the wire, the outer radius of the insulation in the resulting condenser will be 0.102+0.01 or 0.112 inch. The capacity of this condenser by [52] is

$C=0.0388\times3.5/(\log 0.112/0.102)=3.35$ microfarads per mile.

With a voltage of 10,000 volts impressed between the wire and lead sheath, the voltage impressed upon the inner condenser by [56] is

$V=0.253\times10,000/3.35=755$ volts.

Answer to Question c.

If a thin cylindrical metallic shell is now inserted in the rubber insulation at a distance of 0.01 inch from the lead sheath, the internal radius of the insulation in the resulting condenser will be 0.352—0.01 or 0.342 inch, and the external radius will be 0.352 inch. The capacity of this condenser by [52] is

$C=0.0388\times3.5/(\log 0.352/0.342)=11.0$ microfarads per mile.

The voltage drop in this condenser under the conditions of Question (*b*) by [56] will be

$V=0.253\times10,000/11.0=231$ volts.

As a result of these calculations it may be seen that the electric stresses in such a cable are not distributed uniformly throughout the insulating material, the greatest stress existing in that part of the insulation which is in contact with the wire. Since minor stresses are imposed upon that part of the material which is in contact with the sheath it may be possible to substitute for the rubber at this point a cheaper material of lower dielectric strength. The following results, however, indicate the necessity of choosing a material of proper specific inductive capacity for this purpose.

Answer to Question d.

The radius of the rubber insulation at a point midway between the wire and the sheath is 0.125+0.102 or 0.227 inch. The capacity of a condenser of these dimensions by [52] is

$C=0.0388\times3.5/(\log 0.227/0.102)=0.391$ microfarads per mile.

The voltage drop between the wire and a point midway between the wire and the sheath by [56] is

$V=0.253\times10,000/0.391=6,470$ volts.

Answer to Question e.

Since the internal radius of the guttapercha is 0.125+0.102 or 0.227 inch and the outer radius is 0.352 inch, the capacity of the external condenser by [52] is

$C=0.0388\times4.5/(\log 0.352/0.227)=0.918$ microfarads per mile.

The joint capacity of the inner (rubber-insulated) and the outer (guttapercha-insulated) condenser by [54] is

$C=0.391\times0.918/(0.391+0.918)=0.274$ microfarads per mile.

The potential drop in the inner condenser by [56] is

$V=0.274\times10,000/0.391=7,000$ volts.

The potential drop in the outer condenser by [56] is

$V=0.274\times10,000/0.918=3,000$ volts.

The use of an outer layer of guttapercha has then raised the potential drop in the inner layer of rubber from 6,470 volts to 7,000 volts. This increase is due to the fact that the guttapercha has a higher specific inductive capacity than the rubber.

This principle is utilized in the manufacture of cables, the insulation being graded in proportion to the stresses existing within the cables. By selecting for the outer layer a cheaper insulation with a specific inductive capacity not materially greater than that of the inner layer the

ALTERNATING CURRENTS.

Problem 88.

A three-phase transmission line 10 miles long consists of 250,000-circular-mil cables equally spaced two feet apart. The resistance and reactance of this line at 25 cycles are 0.228 and 0.244 ohm per conductor per mile. A constant induction-motor load taking 5,500 kilowatts at 0.916 power-factor and with a line voltage of 13,200 volts is at the end of this line. The generating station has a full-load capacity of 325 amperes per conductor. A synchronous motor is to be added at the *load* both to compensate for the lagging current taken by the induction motors and to supply additional power. Assume that the efficiency of this synchronous motor is 92.5 per cent at full load and unit power-factor. The voltage at the load is maintained constant and the frequency is 25 cycles. (*a*) Calculate the kilovolt-ampere capacity of the synchronous motor so that the generating station can deliver its full load at unit power-factor. (*b*) What additional load can the synchronous motor supply? (*c*) At what power-factor will it be necessary for the synchronous motor to operate? (*d*) What is the necessary line voltage at the generating station before and after the synchronous motor is added?

potential stresses will differ but little from those existing within a uniform insulating material and there will be considerable saving in the cost of the insulating material.

SOLUTION OF PROBLEM 88.

Answer to Question a.

In solving alternating-current problems it is usually best, when considering circuits that are connected in parallel, to take the voltage across the parallel branches along the horizontal axis. When considering circuits that are connected in series it is usually best to take the current in them along the horizontal axis. The vector diagram that shows the relations that exist between the line current and the voltages at the generating station and at the load is given in Fig. 42a. Since this is a simple series circuit the current is drawn horizontally. The resistance and reactance of the line are 2.28 ohms and 2.44 ohms per conductor. The line current is 325 amperes. The voltage per phase (*i. e.*, between line and neutral) is 13,200/√3 at the motor load

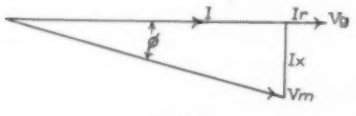


Fig. 42a.

and is unknown at the generating station. The line current and the voltage at the generating station, V_s, are in phase. From this diagram it is readily seen that

$$(V_s-Ir)^2+(Ix)^2=V_m^2$$

$$V_m=13{,}200/\sqrt{3}=7{,}620 \text{ volts.}$$

$$Ir=325\times 2.28=741 \text{ volts.}$$

$$Ix=325\times 2.44=793 \text{ volts.}$$

$$V_s=741+\sqrt{7{,}620^2-793^2}$$

$$=8{,}320 \text{ volts.}$$

The line voltage at the generating station is

$$V=8{,}320\times\sqrt{3}$$

$$=14{,}400 \text{ volts.}$$

This part of the problem is so simple that it makes no difference in what direction the current vector is drawn. The solution has given us not only the necessary voltage at the generating station but also the phase angle, ϕ, between the line

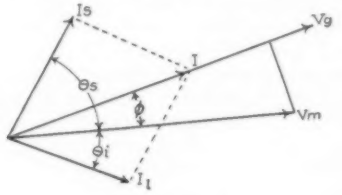


Fig. 43a.

current and the voltage at the motor load.

$$\sin\phi=793/7{,}620$$

$$=0.104$$

$$\cos\phi=7{,}580/7{,}620$$

$$=0.995.$$

The current that the synchronous motor must take in order to satisfy the conditions of the problem is found by solving the vector diagram given in Fig. 43a.

It is now best to draw the voltage at the load along the horizontal axis. The line current taken by induction motor is by [42a]

$$I_1=5{,}500{,}000/(\sqrt{3}\times 13{,}200\times 0.916)$$

$$=263 \text{ amperes.}$$

When we use the phase voltage as that between the line and neutral, then line current is the phase current. The horizontal and vertical components of the phase current of the induction motor are

$$(I_1)_h=263\times 0.916$$

$$=241$$

$$\sin\theta_1=\sqrt{1-0.916^2}$$

$$=0.40$$

$$(I_1)_v=-263\times 0.40$$

$$=-105.$$

The horizontal and vertical components of the total line current are

$$I_h=325\times 0.995$$

$$=323$$

$$I_v=325\times 0.104$$

$$=33.8.$$

By [26a] $323=241+(I_s)_h$

$$(I_s)_h=82$$

$$33.8=-105+(I_s)_v$$

$$(I_s)_v=139.$$

By [27a] $I_s=\sqrt{82^2+139^2}$

$$=161 \text{ amperes.}$$

The rated kilovolt-ampere capacity of the synchronous motor must be

$$Kv.\text{-}a.=\sqrt{3}\times 13.2\times 161$$

$$=3{,}680.$$

Answer to Question b.

The power supplied to the synchronous motor equals three times the power supplied per phase, which is the phase voltage, 7,620, multiplied by the component of the current which is in phase with this voltage, *i. e.*, the horizontal component of the current.

$$\text{Power}=3\times 7{,}620\times 82/1{,}000$$

$$=1{,}875 \text{ kilowatts.}$$

The losses in a synchronous motor are the friction and windage, the core loss due to rotation, the armature resistance loss and the copper loss in the field winding. Of these the first and third are independent of the power-factor at which the motor is operated. The first is constant and the third depends only on the value of the armature current. The core loss due to rotation and the copper loss in the field vary with the power-factor. The former is probably less and the latter somewhat greater than they would be at unit power-factor, but in this problem it is close enough to assume that they are the same as at unit power-factor. The entire losses will then be the same as they would be when the motor delivers its full load and operates at unit power-factor. With a rating of 3,680 kilovolt-amperes and an efficiency of 92.5 per cent, the full-load losses are:

$$(1.00-0.925)\times 3{,}680=276 \text{ kilowatts.}$$

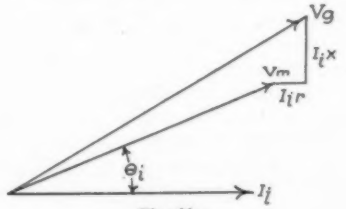


Fig. 44a.

The output of the motor under the conditions given in this problem is

$$P=1{,}875-276$$

$$=1{,}600 \text{ kilowatts.}$$

This is the additional load that the synchronous motor can supply.

Answer to Question c.

The power-factor of the synchronous motor is by [28a]

$$P.F.=82/161$$

$$=0.503.$$

DIRECT CURRENTS.

Problem 39.

A public hall 60 feet wide, 100 feet long and 25 feet high has an unbroken white ceiling and is to be illuminated by tungsten lamps mounted in silvered reflectors and placed close to the ceiling. The power rating, lumens, life and cost of certain sizes of vacuous tungsten lamps are as follows:

Rated watts.	Lumens.	Life in hours.	Cost.
100	908	1,000	$0.70
150	1,430	1,000	1.10
250	2,450	1,000	1.80
400	4,070	1,000	2.90

Assuming that one-half of the lumens emitted by each lamp are absorbed by the reflector, ceiling and side-walls, and that the average illumination on a plane three feet from the floor is to be three lumens per square foot, find (*a*) the proper size and location of the lamps and (*b*) the annual cost of lighting this hall, including the cost of lamp renewal, if the electric energy costs 10 cents per kilowatt-hour and the hall is used four hours in the evening 100 times a year.

This problem illustrates the essential principles of illumination design.

ALTERNATING CURRENTS.

Problem 89, Part I.

An air-core reactor is connected in series with a condenser. The reactor has a resistance of 5 ohms and an inductance of 25 milhenrys. The condenser has a capacity of 31.2 microfarads. An analysis of the wave form of the voltage impressed on this circuit shows that it contains a fundamental with a maximum value of 300 volts, a third harmonic with a maximum value of 100 volts, and a fifth harmonic with a maximum value of 80 volts. The fundamental frequency is 60 cycles. The higher harmonics are so small as to be negligible. (*a*) What are the ampere values of the fundamental, the third and the fifth harmonic currents? (*b*) What is the total current? (*c*) What is the voltage across the reactor? What is the voltage across the condenser? (*d*) What is the power supplied to the circuit?

Part II.

An air-core reactor is connected in parallel with a condenser. The reactor has a resistance of 5 ohms and an induction of 25 milhenrys. The condenser has a capacity of 30.3 microfarads. The same voltage wave as in Part I is impressed on this circuit. (*a*) What are the ampere values of the fundamental, the third harmonic and the fifth harmonic currents supplied to this circuit? (*b*) What is the total current? (*c*) What is the current in the reactor? What is the current in the condenser? (*d*) What is the power supplied to the circuit?

Answers to the above problems and two new problems will be printed in the next issue.

Answer to Question d.

The voltage necessary at the generating station after the synchronous motor is added was calculated in Question (*a*) and is 14,400 volts.

The voltage necessary at the generating station before the synchronous motor was added is found by solving the vector diagram given in Fig. 44a. In this case we have a simple series circuit so that the current will be taken along the horizontal axis. The horizontal and vertical components of the voltage at the load, V_m, are

$$(V_m)_h = 7{,}620 \times 0.916 = 6{,}980$$
$$(V_m)_v = 7{,}620 \times 0.40 = 3{,}050.$$

By [19a] $(V_g)_h = 6{,}980 + 263 \times 2.28 = 7{,}580$

$(V_g)_v = 3{,}050 + 263 \times 2.44 = 3{,}690.$

By [20a] $V_g = \sqrt{7{,}580^2 + 3{,}690^2} = 8{,}430$ volts.

The line voltage is $\sqrt{3} \times 8{,}430 = 14{,}600$ volts.

Philadelphia Section Meeting.

The annual meeting of the Philadelphia Electric Company Section, National Electric Light Association, on May 18, brought to a close an unusually successful year. The number of members attending the Section meetings this year was the largest in the Section's history, reaching the grand total or 3,451 for seven meetings, an average of 493. The meetings this year have not only been well attended but remarkable enthusiasm has marked every meeting and the "get-together" spirit has been developed with most satisfying results. During this year the Section's Concert Band of 25 pieces was organized and developed to a high degree of efficiency. Plans have been drawn for a Section club house and restaurant. Educational courses consisting of classes in mathematics, salesmanship, electrical engineering, accounting and bookkeeping were inaugurated, and the results of the first year in this work are gratifying. There were 1,737 requests made upon the Section Library for books and periodicals. The Membership Committee added 116 new members to the roll, making the net membership 888.

The large meeting of the year was "Ladies' Night," held in January, at which approximately 1,400 of the members and their ladies were in attendance.

The Departmental Branches too have been unusually successful. There was an average attendance of 75 at these meetings, of which 29 were held.

A departure for an annual meeting was the presentation of a subject of particular interest to aerial linemen. W. A. LaDue, division superintendent of the Public Service Electric Company, of New Jersey, delivered a very able lecture upon aerial line construction and spoke especially of the installation in the northern part of New Jersey in the vicinity of Newark. Mr. LaDue's talk was profusely illustrated with lantern slides and an item of particular interest consisted of two reels of motion pictures made at the time the 13,200-volt cable was being erected.

Section officers for the coming year were elected as follows: Chairman, H. P. Liversidge; vice-chairman, A. R. Granger; secretary, A. L. Atmore; Executive Committee, H. Carl Albrecht, W. B. Ahern, Frank T. Adams.

The meeting was concluded with the usual vaudeville entertainment.

Southwestern Electrical and Gas Association.

Annual Convention at Galveston, Tex., May 19-22.

Closer relations with the public through increased publicity, by widening the scope of the organization's work and otherwise, was the keynote of the eleventh annual convention of the Southwestern Electrical and Gas Association, which convened at the Hotel Galvez, Galveston, Tex., on May 19 to 22, inclusive. In both the annual address of President D. G. Fisher, and the annual report of Secretary H. S. Cooper the need in this connection was sounded and the suggestions advanced met with the hearty approval of those assembled.

On the opening of the convention, Mart H. Royston, city attorney of Galveston, extended a cordial welcome to the delegates. John A. Bonner, of Houston, in appropriate language accepted the hospitality extended.

Left Half of Group at Convention of Southwestern Electrical and Gas Association.

Secretary's Report.

Most comprehensive was the report of Secretary Cooper on association affairs. He reported that new companies were conservative about joining the association and that when utilities changed hands almost invariably the missionary work with the succeeding company has to be done all over again. Mr. Cooper urged individuals represented in the association to work for new members. In telling of the growth of the office work during the past year, of the increased demands upon it and the need of even greater expansion, Secretary Cooper said that since the 1914 meeting the office had answered 225 inquiries. He also recommended widening the scope of the work to include questions of policy as well as those of mere operation. He voiced the need of a technical assistant to the secretary, an understudy to take up the work should there be any abrupt change in office conditions, and funds to enable the secretary to visit personally during the year all plants of company members. He urged greater use of the office by members and sought appointment of a committee on public relations to pass on matters involving questions of policy separate from those of operation. The secretary's membership report showed that, in spite of unfavorable business conditions during the past year, there was an increase in membership, there being at present an active membership of 229. There was a total registration of about 400 during the sessions of the convention.

President's Address.

D. G. Fisher, of the Southern Traction Company, Dallas, in his presidential address first reviewed the history of the association and its stated objects. The past year has been a strenuous one for all of the members. "The various public utilities have been passing through a critical period," said Mr. Fisher, "not so much by reason of any changes in the methods of doing business, but because of the attitude of the general public towards all public utilities, as well as from the problems arising through the evolution of governmental regulation. There is a great need of effective publicity. During many years the practice of public service corporations was to observe silence as to all their affairs. There is little cause for wonder that as a result of this practice, the public became imbued with suspicion and distrust. Prejudice and misconceptions were formed against which the utilities must now contend. The temporary judgment of the people is often wrong. Our systems of government are founded on the theory that the people rule, and that their final judgment is right. Surely, therefore, it is the part of wisdom to lay our case fully and fairly before the tribunal to which we must appeal. There is, I believe, a big need for closer co-operation between the public and the public utilities of the Southwest. No better code of principles could be adopted, as a starter, than those laid down by President Wilson in his address before the midwinter meeting of the American Electric Railway Association, which are:

"'First: The rule of publicity—not doing anything under cover—letting the public know what you are doing and judge of it according as it is.

"'Second: The full equivalent for money you receive.

"'Third: A certain kind of conscience in business, a certain feeling that we are after all in this world because we are expected to make good according to the standards of the people we live with.

"'Fourth: The rule of having the spirit of service.'"

Speaking of the competition of "jitney" buses, President Fisher called attention to the "jitneys" in other branches of public service besides that of the street railway. The street railways have for a long time had their "jitneys" in small numbers, so small that their effect was hardly felt and but little attention paid to them; but suddenly through unforeseen and unpreventable causes the "jitney" grew from a dwarf to a giant in a few months. The lesson of the "jitney" should be taken to heart by every

other kind of public service, besides the street railways, and these industries should be in a better state of preparedness than were the street railways in this instance.

After listening to the president's address the meeting divided itself into two sessions, those interested in railroad problems taking up subjects of interest to them and those interested in gas problems carrying out a program on gas subjects.

Among the papers read at the afternoon meeting was one by G. W. Smith, electrical engineer of the San Antonio Traction Company, entitled "Rail Welding" and another by H. T. Sullivan, of Houston, on "A Study of the Jitney." The whole afternoon was devoted to the discussion of these and other subjects of particular interest to street railways.

Boiler-Room Economy.

On Thursday morning separate sessions were held for those interested in light and power subjects and for those interested in accounting. F. N. Lawton, manager, Wichita Falls Electric Company, Wichita Falls, Tex., read a paper on "Boiler-Room Wastes and Economies." He detailed his experience and pointed out particularly that if a boiler room was well kept it usually indicated that the firing was economically done. If, however, the floor was dirty and the brass part unpolished it usually indicated carelessness and inefficient firing.

F. A. Matthes, Long View, Tex., spoke of the practice now in use at his plant of burning Texas lignite by operating the boiler with divided air-tight ash pit, under control with forced draft through the bridge wall under the furnace grate. He stated that with this fuel it was possible to generate from 185 to 190 horsepower on a boiler rated at 150 horsepower. Mr. Matthes said he was able to get this result with either green or dry lignite. This is regarded as an important advance in the burning of Texas lignite and it will be tried at a number of plants to which lignite is accessible. Others taking part in the discussion were H. S. Cooper, Dallas; Charles W. Rogers, Doherty Operating Company, New York; G. W. Smith, San Antonio; R. J. Irvine, San Angelo; W. F. Schmauder, Dallas, Tex.

The morning session was concluded by the reading of a paper by Martin J. Wolf, general sales manager, W. N. Matthews & Brother, St. Louis, Mo., on the subject "Modern Electrical Commercial Distribution." The paper summarized the most important principles of salesmanship and advertising and strongly urged hearty co-operation between utilities, manufacturers, jobbers and contractors.

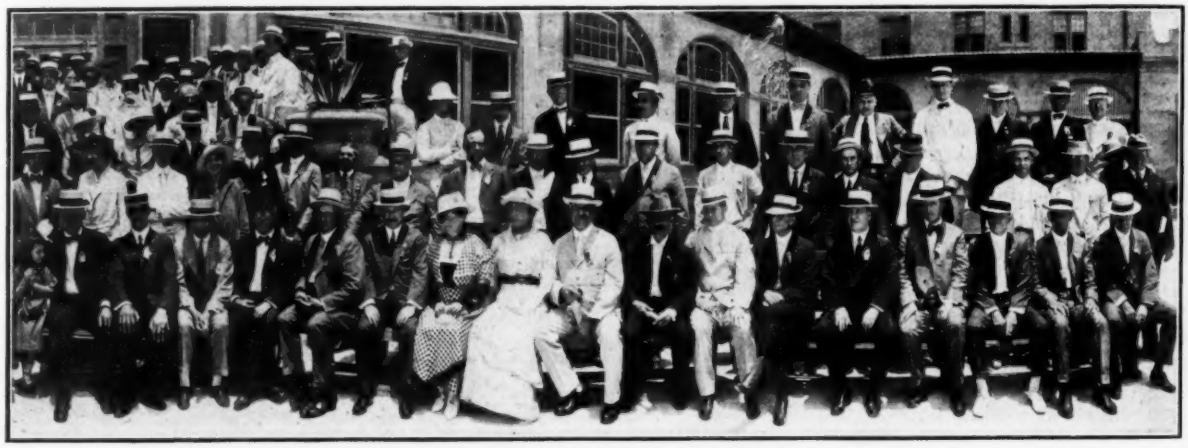
Accident Prevention.

The most popular speaker at the convention was Charles B. Scott, of the Middle West Utilities Company, Chicago, Ill., who spoke on "Important Factors in Accident Prevention." Mr. Scott is secretary of the Accident Committee of the National Electric Light Association, and a member of the leading safety organizations, including the National Council of Safety. He spoke at first of the nation-wide safety movement of the last few years and of the co-operative efforts of some of the largest associations of employers. Among the material results of this work is the development of an ideal first-aid jar and the standardization of danger and safety signs. The Bureau of Safety, with which Mr. Scott is actively connected, devotes itself particularly to safety propaganda among utility companies, who should take a prominent part in safety work, not only among their employees, but among the general public with whom they come in such close contact.

Industrial safety work began when large employers realized the enormous extent of fatal and serious accidents among employees. It was found that 40,000 workmen perished from accidents in this country each year and about 2,000,000 were injured, entailing a total economic loss of $400,000,000 per year. From a realization of these facts arose efforts for the conservation of life and limb, beginning with a close study of the problems. This disclosed that about 15 per cent of industrial accidents originate from mechanical or physical hazards of plant equipment, while the remaining 85 per cent are due to failure of the human element, carelessness, negligence, etc. About the same ratio exists in the electrical industry. This showed the imperative need of enlisting the active co-operation of the employees, which can be done by first showing them that the employer is fully interested by removing the physical hazards of the employment as far as is possible, then impressing on them that self interest and consideration of their families requires that they exercise the utmost care. Street-railway and other transportation companies have had to undertake safety propaganda to educate the public to greater care; other utilities should do so also and should take pride in securing a reputation for active safety work. Such work should have primarily not an economic basis, but one of humanity and love.

A vote of thanks was extended to Mr. Scott for coming to Galveston and giving the association the benefit of his extended experience.

Hartwell Jalonick, commercial engineer, Texas Power & Light Company, Dallas, read a paper on "The Commercialization of the Central Station's Organization." He pointed out that the same principles that are involved in salesmanship in a specific way may be applied to the general work of the central-station organization in all its departments and emphasized that for



Group at Convention of Southwestern Electrical and Gas Association.—Right Half.

such an organization to be successful all of its employees must appreciate that fact.

Advertising Influence of Employee.

At the Friday morning session "The Advertising Influence of the Employee" was the subject of a paper presented by F. R. Slater, Dallas, Tex. He called attention to the important effect produced by the personality of the employee on the esteem in which the utility is held by the public. So important was the subject treated by Mr. Slater, according to the idea of President Fisher, that several others were called upon to discuss this subject. Among those who responded were H. F. Cameron, Lake Charles, La.; Fred Johnson, St. Louis, Mo.; J. C. Kenneday, Brenham, Tex.; Alba H. Warren, Galveston; D. S. Mair, Houston; and Richard Meriweather, Dallas.

In these discussions the expressed sentiment was unanimous that the personality of employees—the individual human elements of the organization—has a large advertising influence; that personality affects salesmanship; that the public forms its opinions about a corporation more in accordance with the conduct of the workmen than with that of the officials, although as it was pointed out by Harry Glass, of Dallas, who also spoke briefly, "every man—from the office boy to the president—is a personal factor in business and salesmanship." He indicated that the broadest field of influence is that wherein the character of the company may be successfully explained by the employee among his associates.

In the absence of A. V. Wainright, of Abilene, who was unable to attend, F. A. Matthes, of Longview, read the former's paper on "What the Southwestern Electrical and Gas Association Can Do For Me."

The morning session closed with a paper on "The Positive and Negative Elements in Trade," by Fred Johnson, St. Louis, Mo. The existence of the buyer and seller is essentially dependent on each other in properly regulated channels of trade, and there should be the closest possible co-operation between the two, according to Mr. Johnson. If properly followed out this will result in the formation of a useful potential that has in its ultimate effect a convergence of the positive and negative elements in trade.

Simplified Accounting System Approved.

A separate session was held Friday afternoon for the accountants at which the report of the Accounting Committee, outlining a proposed simplified system of accounting for medium and small public utilities of railway, light and power, gas, water and ice, was considered and approved. It is expected that this system of accounting will be of great aid to all utility companies, but especially to the small utility companies that are unable to maintain an accounting department. The report is exhaustive in its completeness, giving in detail how to handle the accounts in every department of the work. C. E. Calder, of Dallas, presided at the accountant's session.

Welfare Work Among Employees.

The last session for topical discussion of light and power matters occurred Friday afternoon coincident with that of the accountants. Richard Meriweather, general superintendent, Dallas Street Railways, presented a paper on "Welfare and Educational Work Among Employees; Its Value as an Operating Investment." The paper strongly advocated such work among street-railway men. The reading of this paper precipitated lively discussion by the prominent members of the association, including David Daly, Houston; A. H. Warren, Galveston; W. A. Sullivan, Freeport; V. W. Berry, Fort Worth; H. S. Cooper, Dallas; J. S. Cowles, Freeport.

David Daly said that one feature of the welfare work that had impressed him more than anything else perhaps was the financial assistance rendered employees in case of distress. Building shower baths, auditoriums, theaters or furnishing libraries may fail to arouse the appreciation of employees, but financial assistance in a time of real need makes him feel that the company is human, that it has an interest in his welfare. Mr. Daly also spoke of a little pamphlet issued by the Galveston-Houston Electric Railway Company, called "The Organization." It was a heart-to-heart talk between the manager and the men on the job. The idea of the pamphlet was to encourage thrift and an interest on the part of the employees in petty detailed economies. Prizes were offered for thrift suggestions and a surprising number of these were received. A. H. Warren voiced the opinion that mutual benefit associations were very wonderful breeders of loyalty. These associations so far as possible should be handled by the men themselves and not by the management of the company.

At the Saturday morning session, the committee appointed on the president's address reported approval of the recommendations of President Fisher that a committee, whose duty it would be to act on matters involving the public relations of public utility companies should be appointed. The report of the committee was adopted and the incoming president was authorized to make the appointment.

Election of Officers.

Officers were elected for the ensuing year, as follows:

President, David Daly, Houston, Tex.

First vice-president, F. R. Slater, Dallas, Tex.

Second vice-president, H. C. Morris, Dallas, Tex.

Third vice-president, D. A. Hegarty, Houston, Tex.

Treasurer, J. W. Walker, Dallas, Tex.

Secretary, H. S. Cooper, Dallas, Tex.

The Executive Committee will select the next place of meeting, but in all probability Galveston will again be chosen. Galveston is popularly known as the Atlantic City of the South and in conjunction with the Hotel Galvez makes a delightful place to hold a convention.

Entertainment.

Surf bathing, provided complimentary by the Galveston Commercial Association, was indulged in freely by the delegates to the convention during the four days. The grand ball at Hotel Galvez given by the Suppliers' Section on Wednesday evening, and the entertainment provided on Friday evening by the Jovian Order, were the two principal features of the convention entertainment.

There being no formal entertainments provided for Saturday, the last day of the convention, the delegates went sightseeing, boating and fishing. While the Jovians were giving their entertainment, the ladies played cards and took part in guessing contests for which suitable prizes were offered jointly by the association, the Supplier's Section and members of the Jovian Order.

Of those attending the convention 15 were initiated into the Jovian Order. It was said that the staging of the initiation and rejuvenation was the most complete of any ever held in the South. After the initiation a dinner was served at Colomba's Cafe on the beach at which Ell C. Bennett presided as toastmaster. Talks were made by W. J. Drury, Arthur J. Binz, W. B. Head, H. S. Cooper, Fred M. Lege, Jr., Martin J. Wolf and Fred Johnson. Cabaret singers, dancers and impersonators also provided entertainment.

A great many prominent Jovians attended the convention and witnessed the rejuvenation, among whom were C. W. Hobson (No. 1) and Charles A. Newning (No. 2).

Argentine Imports.

There was a heavy decline in the importation of electrical goods into Argentina last year, the official returns showing a total of $6,830,000, as compared with $9,840,000 in 1913.

Principles of Scientific Street Lighting.

A meeting of the Chicago Section of the Illuminating Engineering Society was held in Chicago on the evening of May 21 at which Arthur J. Sweet, of Milwaukee, Wis., presented a paper entitled "The Principles of Scientific Street Lighting."

In the introduction to this paper the author stated that heretofore the prevailing practice in street lighting has not been along strictly scientific and engineering lines. No comprehensive scientific study of street lighting has been made. An analytical consideration of the problem shows that there are three chief reasons for lighting city streets at night; these are for the safety and convenience of the public, for advertising value and for esthetic value. The first of these can be subdivided into safety from collision, safety from attack, and convenience in recognizing the passer-by. These three constitute the major purposes which should be fulfilled by any thoroughly satisfactory street-lighting system. Further considerations are provision for greater safety from burglary, convenience in avoiding stumbling and avoiding puddles, and also in giving a general sense of security. The advertising value of good street lighting is being recognized in the many so-called white-way installations which have sprung up during the past ten years. Many of these, however, are sadly lacking from a scientific standpoint. It is doubtless true that streets lighted so as to meet the requirements of safety and convenience of the public have for any given expenditure better advertising value than the prevailing glaringly lighted white ways. Since 1905 there has grown in many sections of the country a movement for greater consideration of esthetic effects in street lighting. The result has been a choice of somewhat more ornamental types of posts and lamps. Esthetic effects are obtainable in a scientifically designed street-lighting system which meets the more important consideration of safety and convenience.

Taking up the nature of night vision, Mr. Sweet showed that this is accomplished either by silhouette effect, illumination effect, glint effect or shadow effect. The first of these is made use of in streets which have bright spots near lamps that are spaced a considerable distance apart. Illumination effect requires a reasonably uniform illumination throughout the street and of sufficient intensity to be able to discern the features of a passer-by. Glint effect and shadow effect are minor means for detecting either puddles or obstructions on the sidewalk or street surface. The greater the illumination effect, the less is the silhouette effect obtainable. Therefore, a scientific street-lighting installation must produce conditions favorable to either one or the other of these two methods of discernment. If any serious attempt is to be made to meet the major requirements of street lighting, it is necessary to design the installation so that illumination effect will be employed. This provides adequate illumination upon the face of all objects along the street. This consideration was recognized in the effort made in England to draw up a standard specification for street lighting, in which it was recommended that the minimum horizontal illumination be accepted as the measure of effectiveness of any street-lighting installation. Although this assumes practical uniformity of illumination, a ratio of maximum to minimum illumination of between 5 to 1 and 10 to 1 is as near to uniformity as is practically attainable without excessive cost.

The question as to which type of discernment should be depended on is determined by the funds available for street lighting. If the appropriation available is very small, then the attainment of approximately uniform illumination along the street will give such a low illumination value as to be inadequate in meeting the necessary requirements. Under this condition, therefore, it would be better to depend on silhouette effect and provide lamps at larger distances. In this case, however, these lamps can be so designed and placed as to permit, by the latter addition of intermediate lamps, of obtaining reasonably good uniformity of illumination throughout the street. To secure the minimum of 0.02 foot-candle, which is necessary for good discernment by illumination effect, at any point in the street costs about 15 cents per running foot of street per year. At expenditures above this the illumination will be decidedly improved. At present prevailing practice calls for about 7.5 cents per running foot of street per year for typical residence districts in which an inclosed arc lamp is provided at each street intersection. Consequently by doubling this expenditure a very satisfactory degree of uniformity and high character of street lighting is obtainable.

There are three almost self-evident principles that must be followed in street lighting; these are to generate the light economically, to utilize the light economically, and to leave the eye in an efficient condition to perform its functions. The first of these principles has been given much consideration, particularly in recent years, through the development of improved light sources giving greatly increased efficiency of light production. However, there has not been the most sensible selection of lamp units, even in this respect, in many cases. If the investment in lamps is very heavy, the fixed charges on this decrease the amount available from the total street-lighting appropriation that remains for operation and maintenance. Mr. Sweet showed graphically how the amount of light obtainable for $1 has been increased by the development of improved types of lamps. This was analyzed into the total light generated, the light wasted in the direction of the sky, light wasted in the lamp equipment, light wasted against building fronts, light actually falling upon the street, and finally minimum illumination obtainable between units. This showed in a very striking manner that in all units a great deal of light is wasted, but that in some of the more recent types there has been improvement in throwing more of the light into useful directions and distributing it more uniformly; no type of lamp gives an ideal distribution, however.

In discussing how best to utilize the light generated, Mr. Sweet showed that if the money available is less than requisite to provide illumination intensity for discernment by illumination effect, the light distribution should be such as to produce conditions most favorable to discernment by silhouette effect. If larger amounts are available, then approximately uniform illumination should be provided. Where liberal appropriations can be had, a higher intensity of uniform illumination, together with some lighting of building fronts can be provided. For illumination by silhouette effect the intensity must be about 0.2 foot-candle.

A number of prototype curves typical of the light distribution required for producing sufficient illumination for silhouette-effect and illumination-effect discernment under different conditions of lamp size and lamp mounting height were shown. From these it is possible to select a size of lamp and mounting height to give the effect desired without undue waste. To secure approximately uniform illumination requires a ratio of spacing to mounting height of 8 to 1 or less than this. The prototype curves for the two effects are similar, which shows that by adding intermediate lamps silhouette-effect street lighting can be brought up to the ideals of illumination-effect lighting. Respecting the lighting of building fronts Mr. Sweet stated that this can be accomplished most effectively by flood lighting and that any attempts to secure it by standard street-lighting equipment are as a rule uneconomical.

As a check on the economical utilization of the light is the question of whether it leaves the eye in condition to see effectively. This is the factor of glare in street lighting, which was discussed in an article by Mr. Sweet in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of March 6, 1915, page 439. There is no advantage in providing a physically efficient street-lighting installation with good uniformity of distribution, if its visual effectiveness is reduced by 50 per cent, as is so often the case because of decided blinding effect from low-hung units. Attention to this point permits of equally good final visual effect at greatly reduced illumination intensity. Blinding effect is

diminished by increase in mounting height of lamps or closer spacing of smaller units. As mounting heights decrease below 20 feet the blinding effect increases at a very rapid rate; as they increase over 50 feet, however, the gain in decreased blinding effect becomes very small. Ocular discomfort, another factor in what is commonly known as glare, is reduced by surrounding a brilliant street lamp with an inclosing globe. This alone, however, does not reduce the blinding effect due to the position of the lamp in the range of ordinary vision.

Discussion of the paper was opened by Ray Palmer, commissioner of gas and electricity of the city of Chicago, who commended the paper for its valuable suggestions to the street-lighting engineer for getting greater value to the taxpayer for street-lighting appropriations. Mr. Palmer explained how Chicago had improved its street lighting in recent years along the lines recommended in the paper. Flame lamps of 450 watts and nitrogen-filled tungsten lamps of 300 watts are spaced on the average 23 to the mile and mounted at 22 to 25 feet. In certain residence districts 100-candlepower gas-filled lamps are used and spaced 75 to the mile. A municipal street-lighting system must satisfy the city authorities, particularly the aldermen, and at the same time protect the citizens, consequently pure engineering principles cannot always be followed. Chicago now has about 10,000 flame arcs and 9,000 300-watt gas-filled tungsten lamps in use; the former cost about $50 per year, including operation, maintenance and fixed charges, whereas the latter cost but about $40 per year. Eastern cities are paying as high as $160 a year for similar units. A big saving is being effected for the taxpayers by making the 300-watt gas-filled lamp the standard unit.

P. G. Nutting touched on the glare aspects of the street-lighting problem and called attention to difficulties in lamp mounting arising from dense foliage. L. N. Russell, city engineer, Elkhart, Ind., told of the need for the services of the illuminating engineer in properly designing street lighting. Such aid rendered to the city of Elkhart resulted in greatly improved street lighting and decreased cost.

Harrington Emerson cited some instances of blinding effect and gave his opinion that ideal street lighting would be obtained by means of lamps mounted on high buildings and provided with reflectors to throw the light down on the street. The need for good lighting is very important in order to secure efficiency and the cost of securing this is relatively trivial.

J. N. Cadby gave the result of a cursory inquiry among a large number of laymen regarding the purposes of street-lighting; about 31 per cent said it was to enable one to find the way about. J. R. Cravath mentioned the pioneer work done by Mr. Sweet in showing the importance and characteristics of blinding effect. Albert Scheible called attention to the value of throwing some light on building fronts. M. G. Lloyd commended Mr. Sweet for emphasizing the economic aspects of glare.

In closing the discussion, Mr. Sweet said that Chicago was in advance of most cities in the matter of street lighting. Foliage introduces a difficulty into street lighting, because it limits the possible height of mounting. In Milwaukee residence districts it is possible to go up to 23 feet with center suspended lamps, but only to 15 feet with lamps mounted at the curb line. The solution is in the use of smaller lamps more closely spaced. In summing up the paper Mr. Sweet said his chief aim was to point out the common wastes in street lighting which must be eliminated, to show the need for providing reasonably uniform illumination and to insure that this be of adequate intensity at its minimum value.

How Bell Invented the Telephone.

A brief report was given in the last issue of the annual meeting of the American Institute of Electrical Engineers, which was held on the evening of May 18 in New York City. A list of the newly elected officers was included.

Following the formal business of the evening, the Edison Medal was presented to Alexander Graham Bell. S. S. Wheeler, chairman of the Edison Medal Committee, presided and an introductory address was made by Thomas A. Watson on "How Bell Invented the Telephone."

Mr. Watson recalled the early days when he was employed in the shop of Charles Williams in Boston as a mechanician. The principal electrical work done was in telegraph instruments and in experimental apparatus. In 1874 he began working for Dr. Bell on an experimental apparatus for a harmonic telegraph system. The idea involved in this was to superimpose upon one line a number of currents which were made and broken by the vibration of reeds having different periods. It was intended that receiving apparatus having corresponding natural periods would be set in vibration at the other end of the line. When more than two or three of these were used upon a single line, however, they were found to interfere with each other and it was realized that a simple make and break was not suitable for this purpose, but that sine waves would be necessary. It was this that suggested to Dr. Bell the possibility of transmitting speech. But this possibility was not realized for some time afterward.

On June 2, 1875, while Bell was listening to one of the receivers of his harmonic telegraph he found that the pitch of a vibrating reed in another room could be distinguished. This gave a suggestion which finally led to an actual telephone. One of the early instruments consisted of a diaphragm to receive the sound waves and this in turn actuated a reed which vibrated in front of a magnet. A replica of this instrument was shown by Mr. Watson, the original now being in the National Museum at Washington.

It was not until March 10, 1876, that the telephone first transmitted a complete sentence, which was "Watson, come here, I want you." This was spoken by Dr. Bell and received by Mr. Watson in another building. Mr. Watson also exhibited the wire over which this first sentence was transmitted. When the laboratory was vacated in 1877 he carefully took the wire down and labelled it for future identification.

The telephone was exhibited at the Centennial Exposition in Philadelphia in 1876. Lord Kelvin, then Sir William Thomson, was chairman of the Committee on Electrical Exhibits and was much interested and impressed by Bell's apparatus. At the meeting of the British Association for the Advancement of Science in the following September he referred to it in his opening address.

Up to this time all tests of the telephone had been made on indoor wires. In the summer of 1876 experiments were made upon an outdoor line in Canada and on October 9, 1876, Bell and Watson carried on a long conversation over a telegraph line running between Boston and Cambridge, Mass. This was about two miles long.

The successful working out of the telephone, as is the case with all inventions, was a matter of endless detail. Other tests were made later in 1876 on longer lines and in April, 1877, the first telephone line was constructed, four miles long, and practical operation was begun in competition with the telegraph.

Mr. Watson then referred to the great work which has been done by telephone engineers since the early days, culminating in transcontinental telephony during the present year. Mr. Watson and Dr. Bell carried on conversation between New York and San Francisco at the formal opening of the line between those points on January 25. The amazing growth of the Bell system was referred to, while the use of the telephone throughout the world makes the statistics even larger. There are now 14,000,000 telephone stations in the world with 33,000,000 miles of wire, over which 42,000,000 conversations are made daily.

The presentation of the Edison Medal to Dr. Bell was then made by

President-elect J. J. Carty, engineer of the American Telephone & Telegraph Company. In responding, Dr. Bell referred to the work in the early days and the work which has been done since in developing the telephone by such men as Mr. Carty and his associates. He pointed out that our different sense perceptions are due to vibrations of one kind or another and indicated that there were large fields not yet covered, as the limits of frequencies which can be perceived as sound and light are very restricted. In the great gap between the highest pitch of sound and the lowest pitch of perceptible radiant energy there are electrical vibrations which are used in wireless telegraphy and which may open a field for many other applications.

In closing the meeting President P. M. Lincoln announced that Mr. Watson had that day been elected a fellow of the American Institute of Electrical Engineers.

Annual Report of Board of Directors.

The annual report of the Board of Directors of the American Institute of Electrical Engineers, which was presented at the meeting, showed receipts for the year of $112,774.42. The expenses amounted to $105,874.17, leaving a net revenue of over $6,900. Of this $2,138 was added to the surplus account.

There has been a net increase in membership during the year of 178, the total on April 30 being 8,054.

The Standards Committee intends to present to the Board of Directors in June a revised edition of the Standardization Rules for approval.

Institute Directors Authorize New Section.

The Board of Directors of the American Institute of Electrical Engineers has granted authority for the organization of a section of the Institute in Denver, Colo.

An Institute meeting was authorized to be held at Philadelphia on October 11, and another at St. Louis on a date not yet fixed.

Electrically Conducting Oils.

The electrician generally wants his oil to be an insulator, while the engineer does not much trouble whether or not his lubricant is a conductor of electricity. It is, however, important to know that certain substances impair the insulating power of oils. B. Holde noticed in 1900 that the heavy mineral oils will dissolve soaps (the alkali or alkaline-earth salts of the fatty acids), and form with them a kind of pasty ointment. These pastes did not resist the long continued action of water, however. From the *Berichte* of the Deutsche Chemische Gesellschaft, we see that the calcium and other salts of the naphthalene acids resemble soaps, and that their emulsions with heavy mineral oils are not attacked by water. The naphthalene acids are by-products in refining lubricating oils. The naphthalene acids themselves, Holde finds, do not affect the insulating power of heavy mineral oils to any great extent; but the addition of soapy salts does. Whether this property could further be utilized is uncertain.

There is a demand for conducting lubricants for rolling contacts; for these purposes, graphite seems more suitable than oil, however. Yet it is interesting to remember that benzene is, according to M. M. Richter, rendered less liable to become electrified by friction, and to be ignited by the electric sparks which are dreaded in wool-washing, when magnesium oleate is added to the benzene; the benzene thus treated conducts the current, as was demonstrated by G. Just.—*Engineering.*

Meeting of Electric Power Club.

The Electric Power Club, which is engaged in the commercial standardization of electrical machinery and which embraces in its membership all of the leading manufacturers of electrical machinery, met at Saegertown, Pa., on May 13, 14 and 15 for its annual convention. About 45 representatives were in attendance.

The principal subject discussed at the meeting related to temperature-rise limits for all classes of electrical machinery. It was recognized that the Standardization Rules adopted by the American Institute of Electrical Engineers last year represented maximum permissible temperature-rise and that it was properly the function of the Electric Power Club to determine what temperature standards falling within these limits best meet the actual conditions of commercial practice.

On impregnated fibrous insulation the maximum permissible temperature-rise of the rules of the American Institute of Electrical Engineers is 50 degrees centigrade. On small fractional-horsepower motors, due to the conditions under which most of these motors are operated, and on single-phase motors and direct-current engine-type generators, the members of the Electric Power Club were in favor of maintaining the present commercial standard of 40 degrees centigrade. They were also in favor of deferring until July 1, 1916, any change in the basis of rating standard electric motors sold for general purposes, as it was felt that these were sold under, in most cases, unknown and indefinite conditions of service and that the users of such motors generally expected a greater leeway in capacity than would exist under the 50-degree continuous-rating method. The present commercial standard for open-type general-purpose motors is 40 degrees. It was also felt that on fully inclosed motors, the present commercial standard of 55 degrees should be maintained, although this is five degrees higher than the rules of the American Institute allow. In fully inclosed motors, the temperature within the motor is more uniform, there is less danger of hot spots, and a less temperature-gradient is considered permissible. An effort will be made to have this feature recognized in future revisions of the Standardization Rules.

The following ratings, speeds and shaft diameters were adopted as commercial standards for fractional-horsepower motors:

Horsepower.	Revolutions Per Minute.	Diameter of Shaft Extension in Inches.
⅛	1,700 to 1,750	½
⅙	1,700 to 1,750	½
¼	1,700 to 1,750	⅝
⅓	1,700 to 1,750	⅝
½	1,700 to 1,750	¾
¾	1,700 to 1,750	¾

Reports were presented showing that considerable progress has been made during the past year in obtaining a working basis of co-operation with other associations such as the American Institute of Electrical Engineers, the National Electric Light Association and the new Associated Manufacturers of Electrical Supplies. E. H. Martindale, of the Industrial Power Committee of the American Institute of Electrical Engineers, presented to the Electric Power Club at the meeting his views on the standardization of carbon brushes. This was referred to a committee to work out the standardization of carbon brushes along the lines suggested by Mr. Martindale, including a standardization of length, width, thickness and allowable limits.

A sincere vote of thanks was extended to the retiring president, Francis B. Crocker, for the very valuable work he had done during the past two years in extending the scope and influence of the Electric Power Club along very broad lines of industrial standardization.

At the close of the meeting, the following officers were elected for the coming year:

President, E. R. Harding, of the Holtzer-Cabot Electric Company; vice-president, James Burke, of the Burke Electric Company; secretary, C. H. Roth, of the Roth Brothers Company.

Resolutions of St. Louis Electrical Workers.

The St. Louis local of the International Brotherhood of Electrical Workers at a recent meeting adopted a resolution endorsing the single tax on the site value of land as a remedy for involuntary idleness.

It was Edison who said: "Genius is one per cent inspiration and 99 per cent perspiration."

ELECTRICAL SOUNDING.

By Henry R. Gilson.

The practice of "heaving the lead," as it is called on shipboard, consists in throwing a small cylindrically shaped weight, to which is attached a long cord laid off in fathoms, off the starboard bow of the vessel and allowing the line to run out until the weight strikes bottom, thus ascertaining the depth of water. To accomplish this, the vessel is either stationary or moving slowly. In the latter instance the man making the sounding hurls the lead as far forward as he can, and, as the vessel proceeds forward and the weight downward, walks toward the stern of the ship so that the line shall be as nearly vertical when the weight strikes bottom as possible.

This method of ascertaining water depth is as old as the first vessel. Indians in the early days used it in a modified form, which consisted of running long poles or their paddles vertically down alongside their birch-bark canoes. It has been one of the customs handed down from antiquity which is still in practice. No vessel is without its "lead" and to those who are accustomed to ocean or lake travel, this method of sounding is a familiar one.

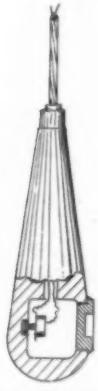


Fig. 1.—Weight Containing Microphone.

Believing that depth of water could be measured by mechanical and electrical means from shipboard, a series of experiments was recently conducted from a boat on the Ohio River. The principle adopted and on which the experiments were based was not unlike that of submarine signaling; viz., if a sound could be produced on the bottom of the sea such as that caused by dragging a weight across a floor and then transmitted electrically to a telephone receiver at the ear of the pilot on shipboard, a means would be provided which would give warning of the vessel's approach into shallow water.

The device which was used in conducting the experiments consisted of a conically shaped piece of cast iron 18 inches long, 4 inches in diameter and weighing about 40 pounds. (See Fig. 1.) Attached to the top was a piece of wire-armored cable 100 feet long containing two No. 16 rubber-insulated stranded copper wires. The armoring wires were clamped at the upper end, and the two insulated wires led through a stuffing box down into a chamber shown at the lower and larger end. Located in this chamber on a thin fiber insulating block and rigidly connected to the back wall was a sensitive granular microphone to which the two wires were soldered. Access was had to this chamber through an opening, closed with a screwed watertight cover. At the outer end of the armored cable, the copper wires were connected in series with two dry cells, a switch and telephone receiver.

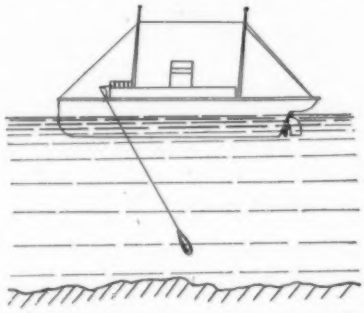


Fig. 2.—Position With Vessel in Motion.

In conducting the experiments, the free end of the armored cable was fastened to the side of the boat and tests made by dragging the sounder in the water at speeds ranging from 2 to 6 miles per hour. By listening in the receiver, it was possible to hear the instant the sounder struck the bed of the river in a shoal location. In dragging over sand or clay a distinct swishing sound was produced in the receiver, while over pebbles and rocks, a series of short staccato knocks was heard. When passing through water with the sounder off bottom, only a faint swishing sound was audible, caused by the friction of the water on the sides of the sounder. The water noises in the receiver had been eliminated by mounting the microphone on a solid rigid wall of the sounder instead of on a thin vibrating diaphragm which had its outer face in contact with the water. In the latter case the sensitive plate-like vibrations of the diaphragm caused by the passage of the sounder through the water, produced such a noise in the receiver, that when passing over sand or clay the contact could hardly be distinguished.

In the former instance it will be noted that the vibrations reaching the microphone were molecular in nature, as the wall of the sounder was restrained from vibrating as a diaphragm because of its shape and thickness. An example of this type of vibration can be shown by scratching one end of a long piece of steel or iron with a pin while a second person places his ear at the opposite end. By holding the ear a few inches away no sound will be audible, but by placing it close, the sound can be plainly heard. In the case of the sounder there had to be a rubbing of some solid substance such as clay, sand or stones against its outer surface before the sound was audible in the receiver.

The tests were conducted over a period of several months and showed conclusively that sound thus produced, regardless of the nature of the bottom, except in the case of thin mud, could be plainly heard by an observer located in a boat on the surface. The shallowness of the river prevented any tests being made in deep water.

In adapting such a device to commercial uses it is to be noted that: (1) in order to use the telephone apparatus the boat would have to be in motion; (2) that the angle of the sounder-supporting cable with the surface will decrease with the speed of the ship and approach 0 degrees as the speed increases; (3) that the depth of the sounder below the surface will be governed by the same condition; (4) that allowances would have to be made when the soundings were taken in an appreciable current; (5) that a direct-reading chart for the operator's use would be necessary in which the length of the supporting cable was a constant and which would contain factors involving the speed of the boat and depth of water.

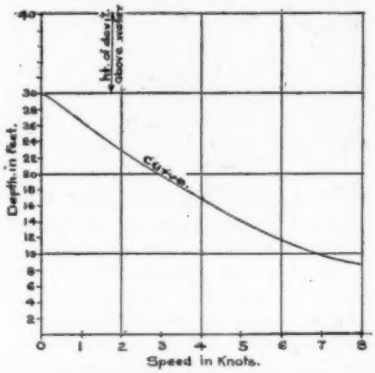


Fig. 3.—Sounding Diagram for Cable 40 Feet Long.

In discussing the foregoing conditions reference may be had to Fig. 2, which represents a moving vessel, having a sounder attached to its side by a cable of length r.

With the given data the depth chart, Fig. 3, can be worked out, in which abscissas represent speeds of the boat in knots, and ordinates the depth of the

water in feet (or fathoms). The value r for each chart would be a constant which, in the case of a boat of medium draft, might equal 40 feet. For a deep-draft boat other charts could be worked out, using a value for r of 100, 125, 150 feet, etc.

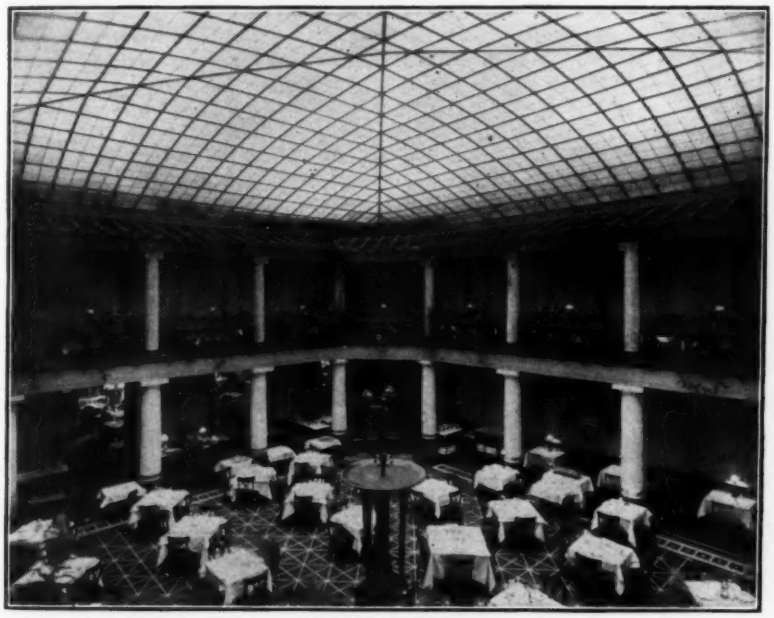
In using this device, convenience suggests that there should be a small davit located at the rail of the ship opposite the pilot house; a small hand winch with a registering dial attached in the pilot house, with the cable running from the drum through the head of the davit and supporting the sounder. The other end of the cable would be attached to the drum and the two copper wires connected to a small armature from which contact wires with a battery in series could lead to a telephone receiver hanging on a switch.

The operation would be as follows. Suppose the boat is proceeding in a thick fog at a speed of 4 knots with the sounder hanging at the head of the davit. The operator unwinds the winch until the dial shows 40 feet of cable has run out, at the same time holding the receiver to his ear. Proceeding in this way a grating sound is suddenly heard in the receiver which indicates that the sounder has struck bottom. Reference to the chart shows that the vessel is in 17 feet of water. In case it is decided to proceed the cable could be reeled in 10 feet and reference had to a second chart worked out with $r = 30$ feet, while the boat continued as before until a depth was indicated where it was dangerous to proceed.

With this method the observations are made in a place where the observer is protected from the elements. The sounding is continuous as against the present intermittent method. The vessel can maintain a faster speed than would be possible under many conditions with the old way. By using two receivers the observation can be made by two operators and instantly checked. The cost of such an apparatus would not prove excessive and if developed commercially should prove of advantage to those concerned.

The Lighting of the Pompeian Room, Hotel Statler, Cleveland.

The lighting of the Pompeian Room of the Hotel Statler is striking in many respects, and the methods of control and light diffusion used by the designer embody features distinct from anything heretofore used in a lighting installation.



Pompeian Room, Hotel Statler.

The design of this lighting system necessitated the fulfillment of two requirements, first, that the lighting system detract in no way from the decorative scheme of the room; the other, that the system be capable of furnishing a variable intensity of illumination. Since the room is designed to represent an Italian garden, the ceiling representing the sky, any large lighting fixtures would be entirely out of place, and the ordinary methods of lighting therefore could not be used. The requirement that a variable intensity of light be available is rather unusual, but its value is apparent to those who have seen places where the lighting effects could not be changed without a prohibitive amount of trouble and expense.

The Pompeian Room receives daylight illumination from a skylight as large as the room itself. In addition, it is provided with a glass ceiling which was already installed before the lighting system was designed. This ceiling is made of roughened diffusing glass; the skylight is provided with the wire-reinforced glass ordinarily used for that purpose. The lighting system provides for 224 25-watt Mazda lamps, placed above the ceiling as shown by the accompanying sketch. The lamps are equipped with Holophane-D'Olier porcelain-enameled steel-dome reflectors and are spaced approximately three feet apart; the arrangement of steel beams prevented an exact three-foot spacing. As the sketch shows, it was necessary to hang a part of the lamps above the steel crossbeams; this required that particular care be taken in spacing these lamps, so that the minimum amount of light from them would be cut off by the steel beams. The hanging height of the lamps was chosen so that the illumination on the ceiling would be uniform. The glass ceiling is not horizontal but is dome shaped; the lighting units are all hung the same distance, four feet, above it. All wiring is carried in steel conduit.

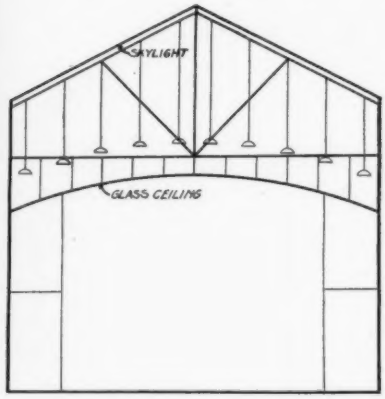


Diagram Showing Location of Lamps.

Two of the interesting features of this installation are the control and dimming arrangements. The 224 lamps are divided into 16 circuits of 14 outlets each. These 16 circuits are supplied from two panel boxes on opposite sides of the room, each box supplying eight circuits. A careful study of the characteristics of Mazda street-series lamps showed that 28 5.5-ampere lamps would provide the correct resistance for dimming thee multiple lamps. Each panel box is supplied with four groups of these lamps. Four remote-control switches control the entire system. The main switches in each panel box are each operated by separate remote-control switches, thus allowing half of the lamps to be turned on at a time. The other two remote-control switches each operate four sets of the series

lamp groups, thus providing two sets of resistances which may be thrown in. Three intensities of light are therefore available, the full intensity without the use of the dimmer, and two lower intensities using the two resistance steps of the dimmer.

The light is entirely diffused and as can be seen from the photograph, there is almost an entire absence of shadow. The amount of light may be varied at will, and as there are no light sources of high intrinsic brilliancy to tire the eye the effects produced are very pleasing. The installation is giving excellent service, and has been found to be satisfactory in every particular.

Development in Hydroelectric Units.

A joint meeting was held in Chicago on the evening of May 24 by the Chicago Section, American Institute of Electrical Engineers, and Electrical Section, Western Society of Engineers, E. W. Allen presiding. A paper was presented entitled "Ten Years' Progress in the Development of Hydroelectric Units." This paper, prepared jointly by Edward B. Ellicott and William B. Jackson, was read by the latter.

The paper opened by calling attention to the extraordinary progress in water-power development during the last ten years. This has been made possible very largely by the developments in hydroelectric equipment, and particularly by great improvements in the design and construction of water wheels. Until comparatively recent times water wheels were built by rule of thumb. The evolution of the design of this type of machine was given by the authors. Water wheels for high heads, that is, 50 feet or higher, are now about eight per cent more efficient and can be had in speeds 50 per cent higher than some ten years ago. This latter result is particularly favorable for the direct connection of generators. The wide range of heads, speeds and sizes now obtainable in water wheels permits the development of many water powers that formerly were considered to be impracticable, because unsuited to the machinery available at the time.

The most important developments in water wheels are in those of very large size for low heads, that is, below 50 feet head. The extraordinary increase in capacity of this type of turbine has been made possible largely by the successful development of step bearings; these permit the use of wheels with a single vertical runner direct-connected to a vertical generator. Refinements in the study of the scientific design of water wheels, together with improved methods of construction, have yielded a very decided increase in efficiency. At the present time there are a very large number of huge water wheels operating at an efficiency of about 90 per cent, a great advance over the highest possible efficiency attainable some ten years ago. The maximum water-wheel efficiency now obtained is about 93 per cent. Manufacturers are now ready to build water turbines to meet almost any requirement in head, size and speed. Recently one manufacturer offered to build a machine of a capacity of 50,000 horsepower.

Great improvements have also taken place in the governors for water wheels, so that these machines may now be governed as well as steam engines can be. Water wheels can now be obtained, if desired, to give their maximum efficiency at part gate opening; thus a machine may be built to give best efficiency at 80 per cent gate opening, which may correspond to its load for perhaps 20 hours of the day and then give nearly as good efficiency at maximum gate opening during the four hours that it carries full load.

In the electrical end of the equipment the problems arising in connection with long-distance transmission have been solved, as they were evolved; each increase in line voltage presented new problems, which have been met as they arose.

In the design of electrical generators to meet the new conditions made possible by the availability of larger water turbines the advance has been chiefly in increase in size, reduction in speed, and great improvement in the mechanical design to withstand the enormous stresses of such large units. These improvements, together with the superior insulation now used, makes the electric generator a practically indestructible part of the hydroelectric plant, at least certainly outlasting the running parts of the water turbine.

Generators have now been built which can operate at continuous full load for several days at no increase in temperature above a safe limit. Considerable attention has been given to the ventilation of such generators and those of the inclosed type are entirely self-ventilating. The use of mica for insulation has greatly improved the electrical ruggedness of the machines. Careful attention has been given to providing reactances for very large machines. Improvement in efficiency has not been so very great, considering the fact that generators at Niagara Falls had an efficiency of some 95 per cent; in the case of very large generators this is now 97 per cent at full load.

In the discussion of the paper there participated R. F. Schuchardt, P. B. Woodworth, L. L. Holladay, H. M. Wheeler, S. Montgomery, P. Junkersfeld, E. W. Allen, E. B. Ellicott and W. B. Jackson. Mr. Montgomery called attention to the prevailing practice in low-head water-power plants, until the last 10 or 15 years, of using bevel-gear drive with a number of vertical water wheels geared to one horizontal generator shaft. He believed that most of the developments in the design of hydroelectric units have taken place in the last five years. Mr. Junkersfeld pointed out the great advance in generator design during the last five years made possible by improved insulation. Mr. Allen said that important advances had also been made in the design of large direct-current generators for direct connection to water wheels in which the problem is even more difficult than with alternators. He explained some of the improved details of generator design obtained through the selection of better material and improved construction. These have permitted a great increase in size at very decided decrease in cost per kilowatt of capacity. He believed that the regulation of a water-wheel generator is less important than its efficiency, because its regulation is better than that of the turbine governor at the best.

Mr. Ellicott said the efficiency of water wheels is now high throughout a wide range of speeds and gate openings, which permits operating under economical conditions at various loads. It has been proposed to employ a chemical test of the amount of water passing through the water turbine by introducing into the penstock above the turbine a saline solution of definite strength and quantity and then testing the dilution of the salt solution in the discharge from the turbine; this test is claimed to be accurate within two per cent; however, it has been employed in only one plant, so far as known. No data had been supplied by the builders of impulse turbines, which accounted for the lack of discussion of this type of machine in the body of the paper.

W. B. Jackson, in closing, said that the development of voltage regulators now makes fine inherent regulation of generators unnecessary. Referring to the testing of water wheels, he called attention to the shortcomings of the Holyoke flume, which has been used as standard for testing of this type of equipment in this country. This flume is too small, however, to accommodate large machines, and the latter are usually tested in the form of small but exact models. Mr. Jackson advocated that the problem be met by the construction by the government of a large testing flume, which could be used in testing water wheels of at least reasonably large sizes.

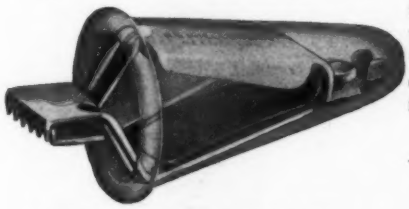
New Electrical and Mechanical Appliances

New Test Clip of Large Capacity.

R. S. Mueller & Company, Cleveland, O., manufacturers of the Universal test clip, have just put on the market a clip of a new size which also has some new features in design. The new clip will carry 20 amperes continuously without heating. The side members are made of copper and the metal spring is enameled so that the entire clip is non-corrosive when used in weather-exposed places. The jaws have an opening or spread of seven-eighths inch so they may be readily applied to large terminals and binding-posts.

In the new clip a screw connection for the cord is provided in place of a connection to be soldered. This meets with special favor among linemen and others who work in the field a long way from headquarters, as with the screw connection they can readily repair the broken cord, a thing they could not do when the connection had to be soldered.

This new 20-ampere clip is also offered lead-plated for use in charging storage



Large-Capacity Insulated Test Clip.

batteries. Rubber insulators are provided when specified, which not only protect the user from shock, but serve to prevent the clips short-circuiting on each other when applied to adjacent terminals. The new model of this clip should prove popular with metermen.

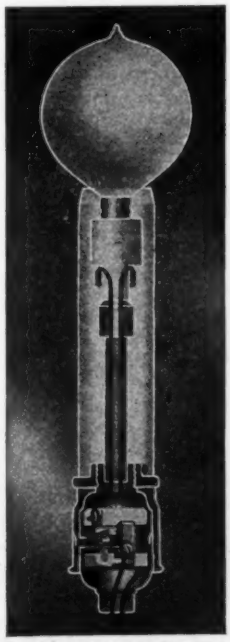
Rotating Switch for Ornamental Lighting Fixtures.

In lighting fixtures of ornate design use of the ordinary key or pull sockets does not add to the beauty of the design, in fact, in the opinion of many it mars the effect. However, it is desirable in many cases to be able to control each individual lamp; this is particularly true of bracket fixtures equipped with candle or candelabra lamps.

This matter has been solved in the Hubbell-Caldwell rotating switch illustrated herewith. The construction is

Rotating Switch for Ornamental Fixtures.

made clear in the sectional view. The switch is operated by rotation of the outer sleeve, which can be given a continuous rotary movement that causes engagement of a brass lip which projects from the segment and thus turns the lamp on and off. Circuit is broken without violent jarring or damage to the lamp filaments. By means of a special tripping mechanism the switch is protected from damage due to reverse turning of the sleeve. The outer sleeve or shell can be obtained in plain or ornamental design and in various finishes to harmonize with the fixture.



Internal Arrangement and Wiring of Switch as Applied to Candle Fixture.

Wiring of the switch is readily done, as shown in the section of the device applied to a candle-light fixture with miniature lamp receptacle.

These rotating switches are manufactured by Harvey Hubbell, Incorporated, Bridgeport, Conn.

A Current-Tap Socket.

Not infrequently there is placed on the market an article that seems to fill a vacant niche and whose convenience is so apparent at first glance that one wonders why it was not thought of before. The idea of the current tap is old; this was one of the earliest of electrical devices. The socket too runs back almost beyond memory. A combination of the two would appear to be desirable. It has remained for the Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill., to perfect this type of socket, and it is now offering for sale the article shown in the accompanying illustration.

Primarily the device is a fixture socket.

Current-Tap Socket with Switch.

The manufacturer has tried to avoid a marked departure from the accepted type of brass-shell socket. The main difference appears in the addition of a housing for the plug attachment, which is small and neat, and does not detract. The entire outfit is a development of the Benjamin plug current tap with switch, described in our issue of January 18, 1913.

The capacity of the plug attachment is sufficient for the purpose of operating any ordinary portable electric device. Control of the socket is by a lever of insulating material, which in the multiple form controls the operation of the lamp, and in the series form gives either series connection, or cuts out the plug, allowing the lamp to burn at full brightness.

This socket should prove an attractive proposition for general household use, wherever it is desired to operate small

electrical appliances from a socket without removing the lamp or doing without a light.

Push-Button Switch Cabinets.

In stores, shops and other places where persons lacking electrical training are employed it is highly desirable to protect electrical equipment of all kinds so as to prevent shocks to any individual or damage to the circuits or apparatus from accidental or careless contact. This protection should be provided particularly for switches controlling lighting circuits, as these are most likely to be used by inexperienced persons. The practice of placing switches in the ordinary lighting cutout cabinet in such installations is therefore a hazardous one and should be avoided.

In view of the numerous safety measures now being generally taken, it is opportune to call attention to what might be called a "Safety First" type of switch cabinet, which is illustrated herewith. In this the cutout portion is in the center, which is provided with a locked door. The switches are of the push-button type and are installed on either side of the cutouts with only the buttons protruding. Thus the switches can be operated without opening the door and without any possibility of touching live parts of the

Push-Button Switch Cabinet.

switch or cutout equipment. Access to the cutouts for renewal is available only to an electrician or other responsible party provided with a key.

These switch cabinets are made of steel and are neatly finished. They are provided with knockouts for one-half-inch conduit evenly spaced on all sides. Installation is very simple. Any standard type of push-button switch may be used; if desired, locking switches may be employed. The entire cabinet is very compact and takes much less space than a regular slate-panel cabinet.

These switch cabinets are manufactured by the Columbia Metal Box Company, 226 East 144th Street, New York City.

Receptacle for Metal Signs and Outlet Boxes.

A new type of receptacle designed especially for use on metal signs or for mounting directly on outlet boxes has been placed on the market by the Arrow Electric Company, Hartford, Conn. This device is provided with a removable porcelain ring. The button on the back is readily removed without using tools. On replacing the button,

New Sign Receptacle.

after the connection is made, the contacts are completely inclosed.

The screw shell is made of a special copper alloy which has been found to withstand deterioration and corrosion due to exposure to variable weather conditions. The screw shells are reinforced by washers under the heads of the retaining screws. The screw shells may be removed from the front without disturbing the sign. The binding screws are spun over to prevent them from falling out. These receptacles fit into a hole 1.5 inches in diameter. They are rated at 600 watts, 250 volts, which gives a good idea of the liberal electrical design.

A New Type of Santo Vacuum Cleaner.

During the last few years, since the first of the so-called "sweeper type" vacuum cleaners was put on the market, dozens of makes have sprung into existence. While most of them accomplish the work for which they are intended quite thoroughly, they are practically all similar in construction and operation. The inability to reach inaccessible places (where the dust and dirt always collect and where cleaning is most needed) has been the greatest fault with all these various makes, because it is impossible to build a cleaner having a motor mounted on wheels near the renovator that can possibly run under anything standing less than six inches from the floor.

We show in the accompanying illustration, however, a little electric cleaner of new design, that is not only radically different in appearance but for which the manufacturers claim many advantages and exclusive features.

Probably the most noticeable departure is the new method of mounting the motor up on the handle instead of directly above or behind the cleaning tool. This method of construction dispenses with all wheels and casters, and makes possible the use of a renovator or cleaning nozzle that will go easily under radiators or heavy low furniture.

Another advantage instantly appreciated by the housewife is the swivel joint at the bottom which permits the handle to be dropped to either side (even to the floor, if necessary) so as to get way back under beds, davenports, buffets, etc., without tipping the cleaning tool from a level position.

It is said to be easier to adapt this cleaner to different kinds of work than any other on the market. A small felt strip for polished floors and a brush strip for rough floors may be instantly snapped into place in the aperture of the cleaning tool and as quickly removed with no other changes or addition of any extra adapters.

Technical men will readily understand

New Type of Electric Vacuum Cleaner.

a further advantage in the design of this cleaner in that it provides a direct passage for the inrushing air to the center of the fan and discharges it radially all the way around the outside, a feature impossible where the motor and fan are mounted between the cleaning nozzle and the dust bag.

This little cleaner is manufactured and marketed by the Santo Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa., and is the latest addition in the well known line of Santo vacuum cleaners, which includes stationary and portable outfits. It is very appropriately known as the "Santo-Handy."

Automatic Starting Switches for Small Alternating-Current Motors.

It is frequently very desirable and more economical to start small alternating-current motors from a distance by means of a push-button or some other contact-making device. To meet the demands of such service, the Allen-Bradley Company, Milwaukee, Wis., has developed a line of automatic starting switches for single and polyphase squirrel-cage induction motors, which can be thrown directly across the line. These automatic starting switches are intended for the remote control of motors driving fans, ventilators, pumps, vacuum cleaners, drill presses, lathes or any other kind of a machine tool.

These self-starters are of excellent mechanical and electrical construction and great care has been taken in their design so that they are as noiseless in operation as is possible. The plain automatic starting switch, Fig. 1, consists of a two-pole, magnetically operated, clapper switch mounted on a slate panel. The clappers are held in the closed position by the magnetic pull of the electromagnet, the terminals of which are connected to the line. This magnet is of liberal design for continuous service and exerts a sufficient pull to insure a good contact of the clappers. Since the circuit to the motor is opened as soon as the elctromagnet is de-energized, this starter affords full no-voltage protection. The various parts of the starter are well proportioned and of ample overload carrying capacity. All switches, with the exception of the very smallest, are provided with a magnetic blowout. The contacts of the clappers are made of hard-drawn copper. They are so shaped and pivoted on a shaft that in closing the switch a long roll contact is effected. The magnetic circuit is built up of sheet steel laminations and is provided with a shading coil which makes the starter practically noiseless. Careful attention has also been paid to the power consumption of the switch in its closed position, with the result that the same has been reduced to a minimum and is too small to be worthy of consideration. The switch is extremely quick and snappy in closing and opening the circuit, which makes its arc-disrupting capacity very great and furthermore materially reduces the expense of replacing contacts. All parts of the apparatus are readily accessible and the contacts can be easily cleaned, which is one of the prominent features of the Allen-Bradley clapper switch.

The type E automatic starting switch for small alternating-current motors is built in several forms to meet the various requirements encountered in the field, of which Fig. 2 illustrates the most complete type. This automatic starter is provided with two adjustable time-limit overload relays, line knife switch and fuses, which equipment absolutely protects the motor against burnouts. Another form of this starter consists of a combination of the automatic switch itself with the line switch and fuses, while in still another form the two time-limit overload relays are substituted for the switch panel. All of these forms are very compact and because of their variety, make it possible to equip the motor with a starter best suited to the existing operating conditions.

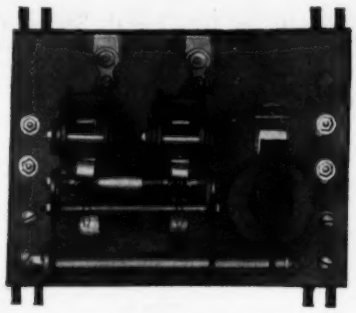


Fig. 1.—Plain Automatic Starting Switch for Small Alternating-Current Motors.

Some kind of a contact-making device, such as a push-button, snap switch, gauge-type pressure regulator, float switch or similar apparatus, is necessary for the operation of this starter. When the line contacts are closed, which in the case of the push-button is done by pressing the starting button, the coil of the clapper switch, which acts as an electromagnet, is energized and its magnetic pull immediately closes the clappers of the starter. These clappers connect the motor directly to the line and the same is accelerated.

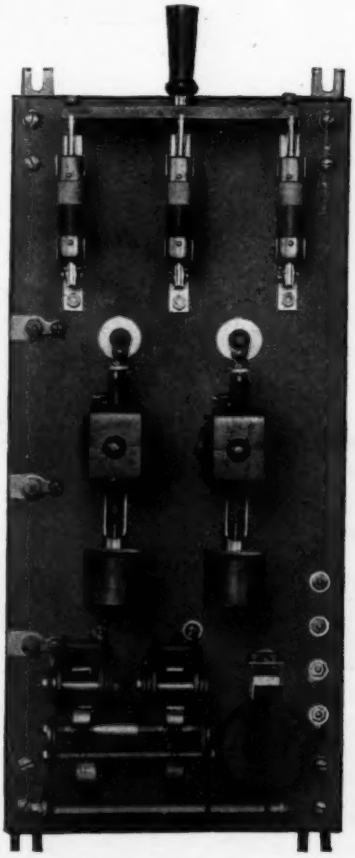


Fig. 2.—Starting Panel with Fused Line Switch, Time-Limit Overload Relays and Automatic Starting Switch.

Although these automatic starters can be used in connection with either a two-wire or three-wire push-button system, it is to be recommended that the latter be given the preference because it permits multiple-station control of a motor, while its protective features are also greater. Of course, where float switches, pressure regulators or thermostats control the operation of the starter, the two-wire system only can be used.

Although the remote control of small alternating-current motors used on machine tools and in similar service has never been given the same attention as has been devoted to this branch of direct-current drive, experiments and practical applications have conclusively proven that the same economies are effected, and the productive capacity of the respective equipment increased. Within the last few years greater advances have been made in the development of magnetic clapper switches than at any other time in the history of the electrical art. The Allen-Bradley Company has taken advantage of this development work and has incorporated in its type E alternating-current automatic starter all the latest features which practice and previous experience have made it necessary to demand of a device of this nature.

New Steam Plant Near Asheville.

North Carolina Electric Power Company has arranged for the erection of an 8,000-horsepower auxiliary steam generating plant on French Broad River, near Asheville. Of the equipment 4,000 horsepower will be installed this year. The company has three hydroelectric generating stations on French Broad and Ivy Rivers with an aggregate capacity of 10,000 horsepower. Electrical equipment for the new plant will be furnished by the Westinghouse Electric & Manufacturing Company.

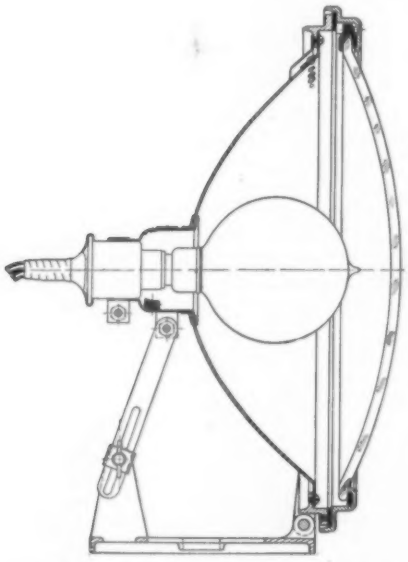
Telescribe Perfected.

On May 23 announcement was made by Thomas A. Edison that he had perfected the telescribe, a device combining the telephone and phonograph into one unit so as to record telephonic messages. This is the development of some 37 years since Mr. Edison first conceived the idea in 1878. A number of practical uses for the telescribe have already been suggested.

This apparatus was described in detail in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 7, 1914.

Illumination of Signs and Building Exteriors by Projectors.

Many gems of architecture are lost to view several hours of the day. Public buildings, edifices of world-wide renown, and other buildings of note with their beautiful and intricate tracery of stone or their dignified simplicity of outline can now be enjoyed and appreciated by night as well as during the daytime. Advertising signs also, instead of "shutting up shop" as night closes in, can be made to tell their message just as effectively as through the day.



Cross-Section of Complete Flood-Light Projector.

Exterior View of Projector.

A new flood-light projector has been designed by the General Electric Company to economically and brilliantly illuminate building exteriors and advertising matter at night.

This projector consists of a highly polished aluminum parabolic reflector, 16 inches in diameter and mounted in an iron frame. The front is covered with curved, heat-resisting glass. This is clamped to the reflector frame and packed so that the whole unit is thoroughly waterproofed and can, therefore, be operated out of doors. All exposed parts are either of non-corroding alloy or weatherproof-coated. The projector itself is well ventilated by a current of cool air which enters near the base of the lamp, circulates around the stem and bulb and passes out at the front top edge of the reflector.

The installation of the outfit is very simple. The most convenient location within a distance of from 25 to 500 feet from the surface to be lighted is selected and the projector bolted or screwed in place. It may be located on the roof of a building, the side of a wall, or mounted on brackets on a telegraph pole. The base of the projector has slotted bolt holes, which permit of a slight adjustment before the final location is made. The best illuminating effect can quickly be determined by test before permanently fastening the unit in place. Since the power consumed by the lamp is only 500 watts at 110 volts, the projector may be connected to an ordinary lamp circuit. The entire outfit weighs about 30 pounds.

The lamp most commonly used is a 500-watt focus-type Mazda gas-filled tungsten lamp in a style G-40 bulb with a mogul base. This type of lamp has its filament concentrated into a very small space and by locating the filament at the focal point of the reflector a narrow beam of light may be projected a great distance. If, however, the surface to be lighted is close to the projector, the lamp filament should be located behind the focal point of the reflector (drawn further into the reflector) in order to spread the beam sufficiently to cover the surface. The very fact that the spread of the beam and its effective distance can be easily and accurately controlled by moving the lamp in and out of focus makes this equipment an excellent one for this type of lighting. The beam may be concentrated to about six degrees divergence with an apparent candlepower in the center of slightly over 400,000 by locating the filament exactly at the focus; by drawing the filament behind the focus, the beam may be spread to 18 degrees, with an apparent candlepower of approximately 150,000 in the center of the beam.

The locating of the filament at the focus is accomplished by directing the beam on any convenient surface 100 to 150 feet away and moving the lamp backward or forward until the smallest spot of light is obtained on the lighted surface. When this is determined, the focusing device may be locked by tightening a clamp provided for that purpose. This keeps the lamp from moving after it has been adjusted.

If the lamp filament is drawn too far behind the focal point of the reflector, a dark spot will appear in the center of the beam. This should be avoided.

With the projector located 100 feet away and the beam concentrated to six degrees, the minimum spread of about 10 feet will be obtained with an average

Billboard Signs Lighted by Flood-Light Projector.

Morgan Memorial Library, Hartford, Conn., Lighted by Projectors.

intensity across its diameter of 30 foot-candles. By spreading the beam to 18 degrees, the maximum spread will be about 30 feet, with an average intensity of 6 foot-candles. If two projectors are trained on the same area, the intensity will be doubled; if trained side by side, thus keeping the intensity constant, the area lighted will be doubled.

The question of the intensity of light required is one which depends largely on local conditions. If the lettering of the sign is white on a dark background, a low intensity is ample. If, on the other hand, the sign is dark and surrounded by powerful street lamps or viewed against other light backgrounds, it may be necessary to use a very high intensity to make the sign stand out conspicuously. For average conditions from 2 to 10 foot-candles produce very satisfactory results.

For lighting long narrow surfaces, such as a row of billboards, it is desirable wherever possible to locate one projector at an angle at each end. By locating the projector at the sides of the board, each one will cover a greater area than if located in front and the beam projected perpendicularly to the surface lighted. For flood-lighting the fronts of buildings, it is desirable to locate the projectors at several different points, so as to eliminate the sharp shadows which might result if all the light came from one direction.

When the area of the surface to be lighted and the probable location of the projectors are known, it is a simple matter to calculate the number of projectors required.

This flood-lighting projector should find a wide use for advertising purposes. Its first cost and maintenance are low, the installation is easy, and it requires no attention whatever, beyond an occasional rubbing up of the reflector and replacing the incandescent lamp at the end of its life.

This class of lighting opens up an attractive field to the central station, since the load is steady and occurs for the most part "off the peak." For the consumer, it affords an economical method of utilizing advertising signs which would ordinarily be worthless after dark.

Submarine Photography by Aid of Quartz Lamps.

In these days of daring exploits of arms when the engines of destruction that operate under water are the cause of so much comment it is pleasing to turn to an equally remarkable but humane and constructive development of science. An achievement that seems destined to play an important part in marine affairs is that of submarine photography, or the taking under water of pictures, both stationary and moving. The actual taking of the photographs is not so difficult, the main requisite being to get beneath the water, to remain there in comfort and be able to perform the work.

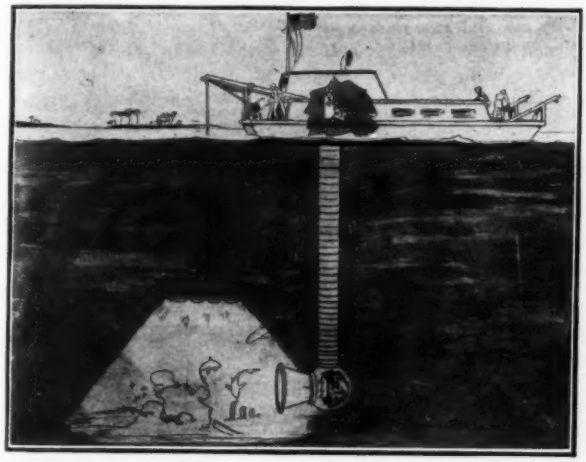


Fig. 1.—Diagram Showing Principle of Submarine Photography.

Fig. 2.—Quartz Lamp Used in Submarine Photography.

This work is made possible by an invention of Charles Williamson and his two sons, of Norfolk, Va., which consists of a collapsible accordion-like submarine tube of waterproof canvas and rubber, three feet in diameter, braced at regular intervals by iron rings. This construction permits the passage of a person down the tube, and its flexibility permits it to be dragged along by a vessel. The top of the tube remains open at the deck; the lower end extends down into the water and expands into a chamber about five feet in diameter, one side of which is provided with a glass observation window through which the pictures are taken. The space in the chamber is sufficient to accommodate two men, one to operate the camera and the other to control the movement of the tube, which is effected by chains operated from the deck of the boat. Fresh air is provided by a simple ventilating device, enabling the operators to work in comfort. The general arrangement is shown in Fig. 1. In order to accomplish submarine photography, however, it was necessary to secure some efficient means of artificial illumination which could be easily handled, would furnish the desired light, and be not prohibitive in cost. After trying other types with varying success, the Cooper Hewitt mercury-vapor quartz lamp, as illustrated in Fig. 2, was adopted. A battery of nine of these lamps, each having 2,400 candlepower, was installed. The essential parts of the lamp are the quartz burner and the auxiliary. The former comprises the light-giving tube, its support and enamelled reflector, while the latter consists of the necessary tilting mechanism and coils for starting and maintaining the mercury arc.

In ordinary commercial use, the burner is suspended from the lower part of the auxiliary and inclosed in a glass globe, but for submarine work the auxiliary is kept on board the boat and the burner with its reflector holder is mounted in a casing that is placed in a frame and lowered into the water. The method of installation is shown in Fig. 1.

Although scientists abroad have been experimenting with undersea photography for many years past, an Englishman, Dr. Ward, having photographed objects in a fish pond at a maximum distance of three feet through the water, it remained for American inventors, the Williamsons, and an American product, the Cooper Hewitt lamp, to successfully solve the problem in a practical manner. Highly instructive and interesting photographs and moving pictures have been taken through the water by the method described for a distance of 100 feet, thus marking an epoch in photography and surprising even the most ardent advocates of the scheme.

Small Mercury-Vapor Rectifier for Charging Automobile Lighting Batteries.

It is no longer necessary for garages to charge automobile lighting batteries from large motor-generator sets or direct-current supply circuits of comparatively high voltage, and thereby waste most of the energy in resistances in order to cut the voltage down to a value suited to the battery. The many types of batteries used on Ford cars, and the large number of batteries installed on cars having their own generators, which, however, occasionally need an extra charge, can now be charged up at a very low cost and with very little trouble.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a small mercury rectifier charging outfit, known as the modified type E, specially designed to suit the needs of public garages that have a number of gasoline-automobile lighting and starting batteries to charge each night.

Rectifier Charging Set for Lighting and Ignition Batteries.

It is a simple and compact little unit arranged for mounting on the wall at whatever point is convenient.

It consists of a cast-iron wall bracket, on the front of which is a small slate panel having mounted thereon the necessary switches and connections. The mercury bulb is mounted behind the panel where it is well protected, and is tilted for starting by means of a knob on the front of the outfit. Back of the bulb and mounted on the wall bracket are the transformer and reactance coil.

The outfit is designed for charging one three-cell battery at a time or a considerable number of such batteries in series. Provision is also made for charging one or two single cells, which is particularly advantageous if there happen to be one or more low ones present. Both five and ten-ampere outfits are available for charging 1 to 18 or 1 to 36 cells, and all outfits are designed for operation on either 110 or 220-volt, 60-cycle circuits. Simple link connections are provided for adjusting the outfit to suit either supply voltage.

The adjustments to suit the different numbers of cells to be charged are all accomplished by changing the transformer connections, and no energy is wasted in series resistance. All adjustments are easily made by means of simple dial switches, and the control of voltage and current is so flexible that practically any desired adjustment may be obtained. It is easy to adjust for a tapering charge, such as is suited to lead cells, or for the more constant-current charge which is best for Edison cells. In both these cases, the outfit does not need to be touched once the charge has been started. Where an attendant is always present, however, the dials can be reset at any time in order to keep the current constant or make the charge follow any desired schedule.

When a number of batteries are to be charged, they are connected in series, as this is the simplest and most efficient method. As each battery becomes fully charged it is disconnected and the charge continued on the rest with a lower dial setting to take care of the smaller number.

Provision is made for mounting a direct-current ammeter on the panel when desired. No provision is made for a voltmeter, as the voltage of a number of batteries in series in different stages of charge would be meaningless. It is necessary to measure the voltage of each battery separately, and a portable voltmeter is best for this purpose.

Such an outfit will fill a long-felt want and make the charging of lighting batteries really porfitable to garages instead of being an expensive but necessary service to regular customers which is frequently conducted without any profit, oftentimes at a loss, owing to the energy wasted in resistance.

The average hourly cost of charging with these outfits at a 5-cent per kilowatt-hour rate for current is about $0.012 for 6 cells, $0.025 for 18 cells and $0.048 for 36 cells, using the ten-ampere outfits. With the five-ampere outfits, the hourly cost for current is correspondingly reduced.

Bulb trouble is practically unknown, due to the low direct-current voltage and the high factor of safety in the new design of bulbs used for the first time with these outfits. The design of the transformer and the starting scheme on these outfits are both entirely unique, making possible a flexibility of control and an ease and positiveness of starting over a wide range of cells and line voltages that would have been impossible with any of the schemes formerly in use.

Similar outfits for the use of the car owner who desires to charge one or two batteries at home are also available.

Improved Forms of Daum Refillable Fuses.

The line of refillable fuses made by the A. F. Daum Company, Pittsburgh, Pa., has recently been improved in several particulars. Fig. 1 shows the new form of knife-blade cartridge fuse, in which the contact blades are made of hard copper and provided with rounded edges; these blades are cast into the brass caps of the cartridge. To secure different ratings the fuse element is made in the form of a strip with horizontal indentations; by breaking off the strip at any desired one of these indentations the rating of the fuse can be made what is necessary through the change in cross section thereby effected.

Fig. 1.—Construction of Refillable Knife-Blade Cartridge Fuse.

Fig. 2.—Construction of Refillable Ferrule Cartridge Fuse.

Formerly it was necessary to cut the strip to the desired width, but by the improved construction this can be done by merely bending and breaking the element where needed.

An improved form of cartridge fuse of the ferrule type is shown in Fig. 2. The clamping arrangement which holds the fuse wire against the caps is now made by dishing the inner contact. Therefore, when the wire is clamped between this contact and the end cap the cross-section of the wire at the middle of the cap is not appreciably changed; the end of the wire which is grasped by the edges of the contact is tightly squeezed and rigidly held in place. This construction prevents the fuse wire from being damaged at the bend where it enters clamping device.

Japanese electrical goods are being introduced in China. They are made cheaper than corresponding American or European goods, but also greatly inferior in quality.

Current Electrical News

ATLANTIC STATES.

WESTBROOK, ME. — A corporation with a capitalization of $200,000 to be known as the Westbrook Electric Company has been organized for the purpose of taking over the properties of the Westbrook Electric Company and continuing the street lighting not only of that city, but also Gorham.

PULASKI, N. Y.—The Henderson Electric Light and Power Company is the title of a stock company which will soon be incorporated for the purpose of supplying electricity for heat, lighting and power purposes in Oswego and Jefferson counties and which will include the townships of Richland, Sandy Creek, Ellisburg and Henderson. Frank E. Hamm, a well known business man of Henderson, with Thomas G. Alvord, of Syracuse and Henderson, are the prime movers in the proposed organization.

GUTTENBERG, N. J.—The Board of Council is considering a new lighting system for the town.

JERSEY CITY, N. J.—Colgate & Company, soap and perfume manufacturers, Jersey City, N. J., have filed plans for an eight-story plant, to be constructed at York, Preene and Grand Streets, Jersey City. The building will cost, it is estimated, $200,000.

JERSEY CITY, N. J.—The Crucible Steel Company of America, Jersey City, plans to construct additional buildings at its plant in Jersey City to cost $380,900.

CHAMBERSBURG, PA.—The merger of all of the gas, electric light and street railways companies in the Cumberland Valley—nine in Chambersburg, Greencastle, Shippensburg and Waynesboro—is proposed by New York capitalists, who have outlined a plan whereby it is intended to form one company having a capital stock of $5,000,000 and float at least $4,000,000 worth of bonds. Options have been obtained, it is said, on all of the nine plants in question, as follows: Shippensburg Gas & Electric Company, Chambersburg Gas Company, Chambersburg & Shippensburg Street Railway Company, Chambersburg & Gettysburg Street Railway, Chambersburg, Waynesboro & Greencastle Street Railway, Greencastle Electric Company, Waynesboro Electric Company, Waynesboro Gas Company and Mercersburg Turnpike Company.

HAZLETON, PA.—It is the intention of councils to have all wires placed underground in the business district here and to erect boulevard lighting standards on Broad Street between Cedar and Locust Streets. R. Alvin Beisel is superintendent of highways.

MAHANOY CITY, PA.—The Rev. Father McEmoes is active in the preliminary arrangements for the erection of a $90,000 church here. The lighting installation will be complete in every detail.

ASHEVILLE, N. C. — The North Carolina Electrical Power Company will build an auxiliary steam-driven electric plant on French Broad River, to cost about $150,000; structure to be of brick, steel and concrete, 120 by 75 feet; 30 feet high; will install generating equipment this year for 4,000 horsepower; ultimate capacity to be 8,000 horsepower.

NORTH CENTRAL STATES.

CALEDONIA, O.—The council has purchased the electric light plant and will operate it as a municipal plant. Improvements will be made.

CINCINNATI, O. — The Beattie Electric Company has secured the contract for the electrical work involved in the Women's Building at the University of Cincinnati, amounting to $3,965. The building will cost about $150,000. L.

DAYTON, O.—The Oakwood Water and Light Compay has increased its capital from $10,000 to $100,000.

MASSILLON, O.—The Massillon Electric and Gas Company has increased its capital stock from $500,000 to $750,000.

MIDDLETOWN, O.—The Ohio Gas and Electric Company is planning the construction of a large electric power plant in or near this city, with a sufficient capacity to furnish power to Middletown, Franklin, Springboro, Trenton, Amanda, Leetonia and New Lisbon, O. The company is now furnishing service to the two latter towns, and is negotiating for the purchase of the plant of the Middletown Gas and Electric Company, which supplies the other five. Application has been made by both companies to the Ohio Public Utilities Commission covering the proposed deal, following the completion of which it is anticipated that arrangements for the construction of the new central plant will be entered into. The necessary financial details, covering the issue of securities to cover this and other plants to be purchased, including those at Franklin, Leetonia and New Lisbon, are also before the Public Utilities Commission. It is stated that the new plant, under present plans, is to be one of the largest in the country outside of the several large hydroelectric plants.

SPRINGFIELD, O.—The electrical wiring and other electrical and mechanical work on the district hospital is to be completed, under a recent resolution of the board of trustees, and will involve an expenditure of several thousand dollars. L.

ZANESFIELD, O.—C. C. Outland, mayor of Zanesfield, and E. Huntzinger of Piqua, are organizing a stock company at Zanesfield, Logan County, to construct an electric light plant.

ANDERSON, IND. — Fire caused damage amounting to about $10,000 to the municipal electric light and water plant.

ANDERSON, IND. — The Public Service Commission authorized the council to issue $50,000 in bonds to purchase boilers, turbines, switchboard and other apparatus for municipal lighting.

WINCHESTER, IND.—The Union Heat, Light and Power Company has increased its capital stock by an issue of $60,000, to purchase the gas plant at Portland, Ind.

QUINCY, ILL.—The capital stock of the Ellington Electric Company has been increased from $15,000 to $20,000.

CATO, WIS.—(OLSON R. F. D.). The capital stock of the Olson Light and Power Company has been increased from $5,000 to $30,000, to construct a hydroelectric power plant.

HOLDINGFORD, MINN.—Val Hermann, of this place, has been granted a franchise to erect an electric light plant. Work on the construction will be started at an early date.

OSSEO, MINN. — The council is planning ways and means to install an electric plant. Address town clerk.

JAMESTOWN, N. D.—A resolution has been adopted and a committee appointed to investigate the feasibility and cost of a municipal electric light plant. If the committee decides favorably the matter will be placed before the people for decision by vote.

MICHIGAN, N. D.—Arrangements will be made at once to install a light plant. Address Mayor J. A. Lamb.

PISEK, N. D.—The people of Pisek are discussing the advisability of putting in a municipal lighting plant. Address town clerk.

TEKAMAH, NEB.—A $15,000 electric plant will be installed. Address city clerk.

KIRKVILLE, MO. — The council is planning to expend $70,000 for improving the light and water system. Address city clerk.

SARCOXIE, MO.—E. W. Johnson has petitioned for a franchise to furnish light and power. A vote on the question will be taken June 1.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—The Harry I. Wood Company has been awarded the contract for installing the electric equipment in the woodworking plant of Gamble Brothers, in Highland Park. This will range between $1,700 and $1,800 and is a conduit job throughout. The Gamble plant will use a total of 21 new motors, which have been contracted for from the General Electric Company, ranging from five to fifty horsepower in capacity.

LOUISVILLE, KY.—The Ford Motor Company, of Detroit, which is erecting a $500,000 plant in Louisville, has specified Louisville Gas and Electric Company power for operating the motors. The connected motor load will be 350 horsepower, and the light

load will range from 50 to 60 kilowatts.

LOUISVILLE, KY.—The Louisville Gas and Electric Company has contracted to supply power for operating the 135-horsepower in motors of the Columbia Sanitary Manufacturing Company, which will manufacture plumbing supplies and fixtures, in the new factory which is nearing completion here. There will be two motors of 30 horsepower; two of 20, and two of 15 horsepower and one 5-horsepower motor used, for which the company is considering offers.

MT. OLIVET, KY.—The Robertson County Light and Power Company, which incorporated some time ago, will build an electric light plant to develop 60 horsepower, and will put up a building at a cost of $500, construction bids to be opened the latter part of June. The company will need equipment and wants prices on switchboard or panel, copper and other materials for the plant. The transmission will run to 8,500 feet. W. R. Bethel is general manager and engineer.

BIRMINGHAM, ALA.—The Avondale Mills have decided upon electric drive for the Eva Jane Mills and Central Mills, at Sylacauga. Motors will be installed and 3,000 horsepower utilized, this electricity to be obtained from the transmission system of the Alabama Power Company, at Birmingham.

SCOTTSBORO, ALA. — The city council is planning to install a street lighting equipment. Address mayor.

SILURIA, ALA.—The Buck Creek Cotton Mills has decided upon electric drive. They will install electric motors to use 1,000 horsepower from the transmission system of the Alabama Power Company, Birmingham.

CLEBURNE, TEX.—It is planned to call an election of tax payers here to vote on the proposition of issuing bonds to take over the street railway system and to make improvements to the property. D.

DEL RIO, TEX.—The Del Rio Electric Light and Ice Company's plant has been acquired by the Texas Southern Electric Company for $90,000. The Del Rio light plant is the sixth to be acquired in this state by the Texas Electric Company, which is a corporation backed largely by Massachusetts capital. The deal for the Del Rio plant was negotiated by Fidelo G. C. Chamberlain, treasurer of the Southern Engineering Company, of San Antonio.

SAN BENITO, TEX. — The city council has adopted plans for a complete street lighting system which will be immediately installed here. D.

WESTERN STATES.

POLSON, MONT. — An electric light plant will be erected here. J. H. Cline, owner.

JUNEAU, ALASKA.—Articles of incorporation for the Spiel River power project have been filed with the Territorial Secretary by E. P. Kennedy, John Rustgard, H. U. Roedling, et al., and the company is negotiating for patents for the establishment of electrochemical factories and power devolopment on the Spiel River. From the most reliable data at present available, it is thought possible to generate electric power on the Spiel River in units of 10,000, 20,000 or 30,000 horsepower, at a cost of not to exceed $5 per horsepower-year. O.

BELLINGHAM, WASH.—It is reported the Whatcom County Railway and Light Company, a subsidiary of the Puget Sound Traction, Light and Power Company, owned and controlled by the Stone & Webster Corporation of Boston, will extend its electric transmission lines south of Bellingham to Enetie, the improvement to be made as soon as materials can be placed on the ground. O.

EVERETT, WASH.—A notice of appropriation of the waters of Twin Lakes, to the extent of 500 cubic feet, has been filed with County Auditor, Mae Weatherbee, by the Jim Creek Water, Light and Power Company, of Arlington. It is reported a power plant will be erected and transmission lines strung throughout the county by the concern, of which Thomas Moran, of Arlington, is president. O.

FRIDAY HARBOR, WASH.—The petition of R. D. Berghardt, of Seattle, for electric light and power franchise, has been granted by the council, and according to reports, a light and power plant to serve this city and vicinity will be erected and serving customers within six months. O.

GRANGER, WASH.—This city is preparing to install a municipal power plant.

MEYERS FALLS, WASH. — The Stevens County Light and Power Company has leased waterpower on the Colville River, known as Meyers Falls, owned by George E. Meyers, of Spokane, and Jacob Meyers and Mrs. J. Cagle, of Meyers Falls. The lease is for a period of 99 years. From reports, it is understood the company will immediately improve a site selected at Meyers Falls by the erection of a concrete dam twenty feet high, with a spillway 500 feet wide, and a power plant with a capacity of 3,000 horsepower which will furnish the towns of Chewelah, Colville, Ward, Meyers Falls, Marcus and Kettle Falls, with current for both light and power. A high-tension transmission line, it is understood, will be constructed between Chewelah and Meyers Falls immediately. The power plant will also furnish electric energy for the United Copper and other mines, located at or near Chewelah. O.

MONTESANO, WASH.—George H. Tilden, Seattle Bond and Brokerage Company, Hoge Building, Seattle, has petitioned the county commissioners, Chehalis County, for a franchise for the construction, maintenance, and operation of power transmission lines over and along the county roads known as Olympic Highway, from the east city limits of the city of Aberdeen, to the east line of Chehalis County, at a point about three miles easterly of the town of McCleary; also from the Olympic Highway along the Summit road to junction of Summit road, and the Summit-Kamilche road, at a point about two miles northeasterly of the town of McCleary. Tilden, representing a large amount of capital, said to be affiliated with Stone & Webster interests of Boston, has also applied for franchises to construct and operate electric transmission systems in the cities of Aberdeen, Olympia and Hoquiam. The councils of these cities will take up the matter of granting the franchises in Hoquiam, June 7; in Aberdeen, June 9; and Olympia, about June 10. The capital which Mr. Tilden represents has a power site at Lake Cushman, and during the past two weeks has applied for franchises for supplying hydroelectric power in the incorporated cities of Thurston, Mason and Chehalis counties.

OLYMPIA, WASH.—W. W. Manier and associates of this city, Scott C. Calhoun of Seattle and G. H. Hilden, as a third concern, seek franchises to construct and operate electric lighting systems in this city. The applications have been referred to the city attorney and council for action.

SEATTLE, WASH. — The King County Commissioners, Byron Phelps, clerk, have been petitioned by G. A. Collins, et al., L. C. Smith Building, Seattle, for a franchise to construct, operate and maintain electric transmission lines on Mercer Island. This is the same concern that was recently granted a franchise by the commissioners, for franchise to construct a power plant and transmission lines on Vashon and Maury Islands. Reported construction of the Vashon Island power plant will begin at an early date. O.

SPOKANE, WASH. — An ornamental curb lighting system on Trent Avenue, from Lincoln to Division Street, has been petitioned for by property owners in that district, and Mayor Fawcett states that if the petition contains enough signatures the installation will be made as soon as possible.

TACOMA, WASH.—An ordinance instructing the city attorney to execute a contract for steam power for an electric generating plant, to be used as an auxiliary to Tacoma's municipal lighting plant, has been passed by the city council. Contract will be between city of Tacoma and Tacoma Central Heating Company. This company proposes to build a $250,000 steam heating plant to supply Tacoma's business section with steam heat at once. The city of Tacoma, at an early date, expects to install electric generating machinery and equipment in the plant. Under the terms of the contract, power to operate the equipment to be installed will be furnished by the heating company. O.

WENATCHEE, WASH.—The transfer of the N. E. Field property at the head of Lake Chelan to the Chelan Electric Company recently marks another step toward the development of power on Lake Chelan. Several years ago the Chelan Electric Company was granted permission to raise the waters of the lake for the installation of an electric power plant.

GRESHAM, ORE.—City officials are investigating water rights near the town of Sandy with a view to installing a power plant. H. J. Stooker has made preliminary surveys, and estimates the cost of the proposed system at about $100,000.

NEW PUBLICATIONS.

EXPORT TRADE.—The National City Bank of New York has published in pamphlet form an address on "Cooperation in Export Trade," by William S. Kies, which was delivered before the American Academy of Political and Social Science on April 30.

UTILITY APPRAISAL.—A paper read before the convention of the Indiana Gas Association by William G. Woolfolk, entitled "Appraisal of Public Utility Properties," has been printed in pamphlet form by Sanderson & Porter, of New York and San Francisco.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 16,754. RESISTANCE WIRES, ETC.—An American consular officer in Switzerland reports that an agent in his district desires to communicate with American manufacturers and exporters of resistance wires or coils and resistance straps or strips.

NO. 16,776. ELECTRIC LIGHT SHADES.—A New York exporter has received an inquiry from an English firm requesting quotations, etc., on enameled-iron shades 6 to 18 inches in diameter; also for white and white and green opal glass shades 6 to 18 inches in diameter. Quotations are desired for large quantities. It is stated that payment will be made in New York City.

NO. 16,777. MACHINERY AND ELECTRICAL GOODS.—A European mechanical and electrical engineer, who is now in the United States, desires to form commercial relations with manufacturers of machinery and electrical goods with a view to representing them in European countries. New York City reference is given.

NO. 16,789. HEATING PLANTS, ELECTRICAL GOODS AND SUPPLIES, ETC.—The manager of an export and import association in this country reports that it is in receipt of a letter from a firm in China which desires to establish commercial relations with American manufacturers and exporters of central heating systems, sanitary equipment and supplies, and electrical goods, such as fans, cells, bells, wiring, lamps, motors, meters, switches, lamp shades, etc. The firm pays cash against the bill of lading or in some cases desires from 30 to 60 days' credit. Catalogs with full descriptive matter, and samples, where possible, should be sent at once. Information as to cablegram codes should also be sent.

NO. 16,790. ELECTRICAL GOODS, COPPER, IRON, ETC.—An American consular officer in Spain reports that a business man in his district desires to establish a commission business for the purpose of handling American-made machinery, electrical goods, copper, iron and steel manufactures, etc. It is stated that this man has been connected with a well known Spanish import firm for a number of years, but is now desirous of taking up the business for himself. Bank references are given.

NEW INCORPORATIONS.

MEADOWS, IDAHO.—The Meadows Light & Power Company has been incorporated with a capital stock of $15,000, by A. R. Krigbaum, T. B. Kendricks and J. M. McCully.

NEW YORK, N. Y.—Kurz Electrical Company. Lamps, machinery, etc. Capital, $25,000. Incorporators: Charles T. Kurz, Finifred M. Smythe and Louis F. Goldmann.

BROOKLYN, N. Y.—Platzer Electric Company, Incorporated; electrical contracting, etc. Capital, $1,000. Incorporators: Morris I. Platzer, Ann R. Platzer and Joseph Platzer.

NEWARK, N. J.—Charles P. Taylor, Incorporated; to deal in electric motors, dynamos, etc. Capital, $100,000. Incorporators: Ralph H. Dixon, Aura H. Higbee and J. Fred Anderson.

NEW YORK, N. Y.—Bruston Electric Lighting and Power Company. Manufacturing agency. Capital, $100,000. Incorporators: Daniel H. Renton, Edward E. Emerson and John L. Bissell.

BUFFALO, N. Y.—Detroit Electric Car Company, Incorporated; to manufacture electric motor vehicles. Capital, $10,000. Incorporators: Charles E. Sager, Helen Sager and George B. Pratt.

NEW YORK, N. Y.—Owl Electric Sign Company, Incorporated; to manufacture electrical works, fixtures, signs, etc. Capital, $5,000. Incorporators: Henry Fantel, William Fantel and Harry Lanzner.

NEW YORK, N. Y.—The Central Station Equipment Company has been incorporated to do electrical contracting and construction work. Capital, $10,000. Incorporators: J. Sarano, J. Landers and F. C. Joutras.

NEW YORK, N. Y.—Sterling Devices Company, Incorporated; to manufacture gas and electric fixtures, etc. Capital, $5,000. Incorporators: William H. Brady, Edgar W. Smith and Frederick H. Stokes.

NEW YORK, N. Y.—Independent Electric Light and Power Company, Incorporated; to manufacture and sell electricity, etc. Capital, $100,000. Incorporators: Meyer Klein, Helen White and Alexander Werner.

SCARBORO, ME.—The Milliken & Snow Company has been incorporated with a capital of $10,000, to conduct an electric light and power business. Incorporators: Alfred H. Milliken, Weston H. Snow, Ezra C. Milliken.

BRONX, N. Y.—Eugene T. Turney Company, Incorporated; to manufacture mechanical and electrical novelties, etc. Capital, $10,000. Incorporators: Eugene T. Turney, L. M. Turney and M. R. Musser, all of New York City.

ELIZABETH, ILL.—The Elizabeth Light and Power Company has been organized with a capital of $6,600. Those interested are Bernhard Dittmar, N. A. Gault, A. L. Cox, John Hagie, Frank Fraser, J. C. McKenzie and S. B. Reynolds.

SPRINGFIELD, MASS.—The W K. Tuohey Company has been incorporated with a capital stock of $20,000 for the purpose of conducting an electrical contracting business. The incorporators are: Wm. K. Tuohey, Thomas F. Tuohey and Frederick K. Tuohey.

DOVER, DEL.—The Eastern Shore Gas and Electric Company has been incorporated to construct, maintain and operate works for the distribution of gas, electricity, etc. Capital, $750,000. The incorporators are: F. R. Hansell, of Philadelphia, Pa., and George H. B. Martin and S. C. Seymour, of Camden, N. J.

FINANCIAL NOTES.

The Southern California Edison Company has sold to a syndicate formed by E. H. Rollins & Sons, $2,168,000 five-year six-per-cent convertible debentures which will be sold at par and interest. The issue, as approved by the California Railroad Commission, was $2,500,000, but $332,000 of the debentures will be exchanged for an equal amount of debentures issued April 1, 1911. The debentures are convertible at the option of the holder into the common stock of the company on the basis of 11 shares of stock for each $1,000 debenture. Proceeds of the debentures will go to pay floating debt of $1,596,890, for additions and betterments of the property, and to reimburse the treasury for expenditures made for capital account.

Gross sales of the Westinghouse Electric and Manufacturing Company in the year ended March 31 amounted to $33,671,485, as compared with $43,733,646 the year before. From this total $2,009,744 was saved as net income available for dividends, against $4,058,809 in 1914. Holders of preferred and common stock received $1,707,259 in dividends, and as the profit and loss account was charged with $444,498 for depreciation and adjustments and $126,257 for miscellaneous reserves, the net revenue was not sufficient by $268,000 to offset debits against it. The total surplus at the end of the year was $7,473,411, as compared with $7,659,130 twelve months before.

The value of unfilled orders, as set forth in a summary of the annual report issued recently, was $8,951,410 on March 31. On that date of 1914 they amounted to $7,951,385. The average number of employees during 1915 was 15,145, against an average of 18,635 in 1914.

The chairman, Guy E. Tripp, informs stockholders that the sale of the French branch to the British branch of the Westinghouse interests was completed in the year. The Italian branch is now controlled also by the English Westinghouse concern. The large reduction in sales, said Mr. Tripp, was largely caused by a strike of more than a month's duration last summer at the main works in East Pittsburgh.

Dividends.

	Term.	Rate.	Payable.
Am. Pr. & Lt. com..	Q	1 %	June 1
Baton Rouge Elec. pf.	S-A	$3.00	June 1
El Paso Elec. com...	Q	$2.25	June 15
Norfolk Ry. & Lt....	S-A	3 %	June 10
Rochester Ry. & Lt. pf.	Q	1.25%	June 1
So. West. Pr. & Lt. pf.	Q	1.75%	June 1

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 24	May 17
American Tel. & Tel. (New York)	118¾	118¼
Commonwealth Edison (Chicago)	133	133
Edison Electric Illuminating (Boston)	233½	234
Electric Storage Battery common (Philadelphia)	50¾	50¼
Electric Storage Battery preferred (Philadelphia)	50¾	50¼
General Electric (New York)	152½	147⅝
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	6	6
Massachusetts Electric preferred (Boston)	38	39
National Carbon common (Chicago)	131	131
National Carbon preferred (Chicago)	120	—
New England Telephone (Boston)	129	129
Philadelphia Electric (Philadelphia) (ex-dividend)	23⅝	23⅞
Postal Telegraph and Cables common (New York)	76	76
Postal Telegraph and Cables preferred (New York)	63	63
Western Union (New York)	66	64½
Westinghouse common (New York)	96	86½
Westinghouse preferred (New York)	120	120

Reports of Earnings.

VIRGINIA RAILWAY & POWER.

	1915	1914
April gross	$ 410,934	$ 420,582
Net after taxes	72,071	90,509
Ten months' gross	4,271,727	4,284,091
Net after taxes	833,225	878,570

DAYTON POWER & LIGHT COMPANY.

	1915	1914
April gross	$ 82,150	$ 75,474
Net earnings	37,906	38,018
Surplus after charges	19,771	21,189
Twelve months' gross	981,283	849,862
Net earnings	452,059	367,927
Surplus after charges	241,095	166,200

DETROIT EDISON.

	1915	1914
April gross	$ 600,082	$ 512,007
Net	225,341	174,948
Surplus after charges	142,355	106,561
Four months' gross	2,611,443	2,215,410
Net	1,023,224	808,411
Surplus after charges	691,406	536,366

NEW ENGLAND POWER.
(Consolidated Statement.)

Earnings for the four months ended April 30 are as follows:

	1915	1914
Gross earnings	$439,010	$342,389
Net after taxes	280,912	210,988
Balance after bond interest	160,528	99,772
Surplus after other interest	147,246	91,671
Balance after preferred-dividends	52,021	9,471

AMERICAN TELEPHONE & TELEGRAPH COMPANY.

Earnings report for three months ending March 31, 1915:

Earnings:	1914	1915
Dividends	$6,295,408.62	$6,306,103.50
Interest and other revenue from associated companies	3,634,392.48	3,445,001.38
Telephone traffic (net)*	1,496,654.27	1,570,773.48
Other sources	137,547.98	272,615.68
Total	11,564,003.35	11,594,494.04
Expenses	1,330,572.12	1,317,798.18
Net earnings	10,233,431.23	10,276,695.86
Deduct interest	2,048,669.58	1,876,605.69
Balance	8,184,761.65	8,400,090.17
Dividends paid	6,892,549.82	6,968,759.99
Balance	1,292,211.83	1,431,330.18

*One month estimated.

PERSONAL MENTION.

MR. FRED UNGER, former manager of the municipal light plant of Chicopee, Mass., has accepted an executive position with the Remington Arms Company, Bridgeport, Conn.

PROF. ALFRED STILL, of Purdue University, Lafayette, Ind., sailed this week for England, where he will devote the summer months to some special electrical work for W. T. Glover & Company, manufacturing electrical engineers, of Manchester.

MR. RAY PALMER, commissioner of gas and electricity of the city of Chicago, gave an interesting talk on "Chicago Street Lighting" before a joint meeting held at Lewis Institute, Chicago, on May 20, by the Lewis Institute Branch, American Institute of Electrical Engineers, and the High Tension Association.

MR. FRANK E. GETTS has been appointed general manager of Electrical Engineers Equipment Company, Chicago, Ill. Mr. Getts was formerly district sales manager of the Chicago office of the Alberger Pump & Condenser Company, and before that he was for a long time associated with the electrical industry.

MR. CLINTON WHITE, for more than 20 years a member of Massachusetts boards, retired May 18 from the Public Service Commission, on which he had served since its creation, having previously been a member of the Railroad Commission. Mr. White reached the age of 70 years, at which retirement from the Commission is provided for by the act which instituted that board. He has been a faithful and highly respected public official.

DATES AHEAD.

National District Heating Association. Annual convention, Hotel Sherman, Chicago, Ill., June 1-3. Secretary, D. L. Gaskill, Greenville, O.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Minnesota Electrical Contractors' Association. Semi-annual meeting, Duluth, Minn., June 10. Secretary, G. M. Jones, 14 Seventh Street, N., Minneapolis, Minn.

Electrical Supply Jobbers' Association. Summer meeting, Hotel Statler, Detroit, Mich., June 15-17. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago. Ill.

Association of Railway Telegraph Superintendents. Annual meeting, Rochester, N. Y., June 22-25. Secretary, P. W. Drew, 112 West Adams Street, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, Ames, Iowa, June 22-25. Secretary, F. L. Bishop, University of Pittsburgh, Pittsburg, Pa.

Northern White Cedar Association. Midsummer meeting, Beaudette, Minn., June 25-29. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Michigan Section, National Electric Light Association. Annual convention cruise, Steamer *Rochester*, June 26 to 30. Secretary, Herbert Silvester, 18 Washington Avenue, Detroit, Mich.

American Institute of Electrical Engineers. Annual convention, Deer Park, Md., June 29-July 2. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

National Electrical Contractors' Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcroft Building, San Francisco, Cal.

With the Electrical Manufacturers

The Usona Manufacturing Company, Incorporated, 1 Hudson Street, New York City, is sending to dealers copies of a folder on its Kwiklite electric flashlights and lanterns; this calls attention to the selling merits of these products.

The Corliss Carbon Company, Bradford, Pa., manufacturer of motor and generator brushes exclusively, has removed its office and stock room to the Engineering Building, 114 Liberty Street, New York City. The eastern district is in charge of a competent engineer.

Delta-Star Electric Company, Chicago, Ill., is distributing a new folder (No. 49) describing the automatic high-speed sphere-gap S & C lightning arrester. The valve action of this arrester is well demonstrated, and will be of interest to those interested in high-tension transmission.

The Albert & J. M. Anderson Manufacturing Company, Boston, Mass., has opened a San Francisco office at 613 Postal Telegraph Building, in charge of Barry G. Durham, who has been with the company for several years, formerly in the Boston office and for the last two years connected with the Chicago office.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has published as Section CS80 of Westinghouse motor applications a reprint of a paper on "Co-Operation Between the Motor Manufacturers and the Central Station," which was presented by W. H. Patterson before the March meeting of the New Business Section of the Ohio Electric Light Association.

The Electric Storage Battery Company, Philadelphia, Pa., has issued bulletin No. 149 dealing with the Exide battery for marine wireless service. This points out the necessity for having a storage battery auxiliary to provide current for marine radio sets. Typical installations of batteries and control panels therefor are illustrated, also several vessels in which such sets have been installed.

Keuffel & Esser Company, 127 Fulton Street, New York City, has issued a folder containing the Brunton Slope Chart for the determination of the apparent angle of sections when cut at planes of varying degrees of divergence from true dip, or vice versa. While particularly valuable in the preparation of maps and geological sections, this chart is also useful for giving the valley angles in hoppers, ore bins, etc. Copies of the circular can be had on application to the company.

Graphite Metallizing Corporation, Yonkers, N. Y., has published Booklet E,

devoted to Graphalloy brushes and contacts for generators, motors, converters, controllers, contactors, and other electrical apparatus. These are made from solid, pure graphite which is impregnated with copper by means of a special process. Graphalloy contacts are used very successfully for elevator and other controllers and circuit-breakers; the brushes are used on low-voltage commutators and collector rings and wherever high current-carrying capacity is required.

Simplex Wire & Cable Company, Boston, Mass., is now represented in New York City by William K. Sparrow, with an office at 30 Church Street. Mr. Sparrow has been connected with the electrical industry in and around New York since 1887, having been associated with the Edison Machine Works, Manhattan Electric Light Company and the Brooklyn Edison Company. In 1892, he had charge of the construction of the underground system at the World's Columbian Exposition at Chicago. From 1902 to 1914, Mr. Sparrow was sales manager for the Fibre Conduit Company.

Wesco Supply Company, St. Louis, Mo., has ready for distribution its new general supply catalog No. 200. This consists of 1,280 pages covering practically all standard electrical supplies now on the market. The material has been arranged in the way in which it is used in an electrical system, beginning with supplies for the power station and ending with sockets, incandescent lamps and electrical appliances used commonly on lighting circuits. The company has also published catalog No. 210 for hardware and garage men; this also consists of 1,280 pages, but differs from catalog No. 200 by the elimination of power station supplies which take up the first 192 pages of that catalog. In place of these pages there have been substituted 192 pages devoted to automobile accessories. This is a new line for the company, but has been added in response to a general demand and it is believed that these supplies will meet a ready market.

Roller-Smith Company, 203 Broadway, New York City, has issued a circular describing its portable voltammeter for automobile lighting and starting systems. This instrument is particularly useful for inspectors who must examine lighting and starting equipments in large garages or the like. The instrument is a compact combination device with three voltage scales and two current scales. The binding posts are conveniently marked so that errors in connections are eliminated. The company has also issued small folders on its Imperial type instruments for automoible use. These are small ammeters ranging to 15 or 20 amperes and are made in several different types especially for use with automobile lighting systems. Another folder describes what are known as "C. O. D." indicators for use with automobile lighting and starting systems. These show at a glance whether the battery is being charged, open circuit, or discharged.

Oshkosh Manufacturing Company, Oshkosh, Wis., will have ready in about a week its new catalog No. 45. This, in the opinion of the company, will be the most complete catalog of strictly outside construction tools issued by any manufacturer and can be furnished either in bound or in loose-leaf form. Sheets can be supplied that conform in every way to those in the Electrical Supply Jobbers' Association "Red Book," also a discount list on the same size paper, perforated for ready insertion. Bound copies or sets of sheets can be supplied direct from Oshkosh or can be had from any of the Oshkosh Manufacturing Company representatives as shown in their advertisements. Although the company markets its entire output of tools through the recognized jobbers, it is glad to supply all operating companies with catalogs and will do so upon request.

Edison Storage Battery Company, Orange, N. J., has issued in the form of a well illustrated pamphlet a letter by Miller Reese Hutchison, dealing with the provision of an emergency source of power for the operation of marine radio apparatus. Extracts from the radio communication laws of the United States and of the International Radiotelegraphic Congress are given to show that such emergency power is required. Mr. Hutchison's letter points out the importance of this subject and shows that the Edison battery has been installed in quite a number of naval and merchant-marine vessels and meets the requirements exactly. Data on several types of Edison batteries suitable for the purpose are given and typical installations are described. In another pamphlet the company has published illustrated descriptions of Edison batteries and of installations thereof for yacht lighting, launch service, ignition in motor boats, wireless service and other branches of marine service.

Record of Electrical Patents

Issued by the United States Patent Office, May 18, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,139,476. Rapid Photographic Record of Curves of Oscillographs, Rheographs, and the Like. A. E. Blondel, Paris, France. Arrangements of mirrors, reflectors, lenses and screen.

1,139,486. Indicator. W. F. Caldwell, assignor of one-half to J. A. Riggs, Hot Springs, Ark. Alarm when insulation on conductor is destroyed.

1,139,487. Electric-Power Transmission Pole. G. D. Cangia, Naples, Italy. Frame for mounting suspension-type insulators.

1,139,489. Indicator. L. Church, Mobridge, S. D. Movable weight connects successive lights in a battery circuit including a bell.

1,139,493. Dynamo-Driving Mechanism. J. L. Creveling, assignor to Safety Car Heating & Lighting Co., New York, N. Y. Disconnectible connection with car axle.

1,139,512. Train-Stopping Apparatus. McK. R. Fulks, Gaithersburg, Md. Lever on car cuts off power on engagement with danger arm along way.

1,139,521. Automatic Ignition and Lighting System. J. A. Heany, assignor to A. E. L. Leckie, Washington, D. C. Has generating unit independent of engine.

1,139,542. Reflector for Electric Lights. D. J. Lambert, Fairburn, Ga. Street lamp has reflector about base of lamp and another at maximum diameter of bulb.

1,139,554. Lamp-Cord Reel. A. MacLean, New York, N. Y. Controlled by electromagnetic clutch.

1,139,614. Electric Sign. H. S. Williams, Ithaca, N. Y. Indirect illumination, has reflector mounted on back of lens.

1,139,623. System for Producing High-Tension Currents. C. I. Zimmerman, deceased, assignor to J. G. Zimmerman, Chicago, Ill. Circuit contains in series, inductance, capacity, alternator and gap varying with current.

1,139,632. Electrical Receiving Apparatus. T. B. Booth, Newton Center, Mass. For Hertzian waves; selection and energization of translating devices effected in response to impulses.

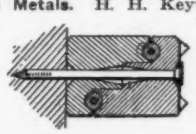
1,139,654. Spark Plug. R. J. Farrell and F. A. Ardron, Seattle, Wash. Details.

1,139,668. Electrical Incandescent Lamp. H. Gerdien and M. von Pirani, assignors to Siemens & Halske A-G., Berlin, Germany. Gas filling contains mercury and a partition above filament permits restricted gas passage between chambers thus formed.

1,139,674. Motor Vehicle. E. Gruenfeldt, assignor to Baker Motor Vehicle Co., Cleveland, O. Mounting and gearing of motor.

1,139,678. Motor-Car Drive System. H. F. Hitner, Mount Vernon, O. Clutching and controlling arrangements in a mixed drive comprising an engine, motor dynamo and storage battery.

1,139,686. Apparatus for Removing Tarnish from Metals. H. H. Keyt, Chicago, Ill. Container of electropositive metal has removable bottom.



No. 1,139,748.—Reversible Insulating Cleat.

1,139,687. Separable Circuit Device. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Two-part attachment plug has self-aligning contacts.

1,139,688. Sadiron Support. J. F. Lamb, assignor to Landers, Frary & Clark, New Britain, Conn. For handle and connecting receptacle of electric flatiron.

1,139,694. Spark Plug. W. M. Marean, assignor of one-half to W. S. Brown, Belvidere, Ill. Dead-gas chamber plug having adjustable electrode.

1,139,707. Ignition-Timing Device for Internal-Combustion Motors. W. E. Nickerson, assignor to E. D. Chadwick, Winchester, Mass. Controlled by intake suction.

1,139,722. Selector Switch. J. N. Reynolds, assignor to Western Electric Co., New York, N. Y. For automatic telephone; rotating bars cause interengagement of contacts.

1,139,723. Illuminated Sign. E. A. Rich, Jr., Chicago, Ill. Lighted from tube lamp at top.

1,139,725. Vehicle Lamp. M. M. Riphahn, Waunakee, Wis. Has two superposed headlight sections of different powers.

1,139,748. Insulator. T. W. Beatty, New Cumberland, W. Va. Reversible cleat made of two interchangeable parts. (See cut.)

1,139,757. Theft-Prevention Device for Automobiles. F. K. Fassett, assignor to L. Ehrlich, St. Louis, Mo. A disabling device and alarm sounded on improper attempt to remove disability.

1,139,759. Electrical Igniting Device for Automobile Lamps and the Like. F. N. Fox, Woodstock, O. Mounting of sparking wires for acetylene gas tip.

1,139,764. Junction Board. H. Hodgson, R. Hodgson, and J. Glazbrook, Chicago, Ill. Binding-posts on busbars let into insulating base.

1,139,778. Electrochemical Process of Treating Waters, Liquids and Sewage. C. P. Landreth, Philadelphia, Pa. Nascent oxygen produced in the solution by electrolysis.

1,139,783. Starting Mechanism for Internal-Combustion Engines. A. Loomis, assignor to Packard Motor Car Co., Detroit, Mich. Comprises electric motor and storage battery with controlling means.

1,139,789. Circuit Breaker. R. B. Macnish, St. Louis, Mo. Continuously rotating for ignition system.

1,139,810. Locomotive with Haulage Mechanism. F. L. Sessions, assignor to Jeffrey Mfg. Co., Columbus, O. Relates to gearing of cable drum on electric mining locomotive.

1,139,821. Coupling for Flexible Tubing.

A. Sundh, Hastings-upon-Hudson, N. Y. Inner and outer conical members for securing the tube ends and holding them distended with plastic material between the tube ends.

1,139,832. Testing Device for Electric-Current Transiating Devices, Fuses, Etc. H. L. Bartlett, Devils Lake, N. D. Arrangement of switches, contacts and a testing lamp for connecting in series with device to be tested.

1,139,839. Safety Device. M. J. Bottinelli, Kellogg, Idaho. For belting; derangement of part, as loose belt lace, closes circuit.

1,139,846. Rifle-Range Shot-Indicator. E. D. Church, Hartford, Conn. Miniature target having location annunciators operated from a distance by similarly arranged push-buttons.

1,139,859. Automatic Fire-Alarm System. F. Gottschalk, Stirling, N. J. Abnormal heat removes weight from telephone hook through fusible link.

1,139,876. Controlling Valve. L. E. Jones, J. W. Breakey and W. F. Casey, Philadelphia, Pa. Energizing solenoid releases valve to permit opening.

1,139,882. Electric Power-Transmission System. J. R. Markle, Chicago, Ill. Means for controlling gas-electric vehicle-propelling unit comprising prime mover, generator, motor and simple control gear.

1,139,902. Floor Selector-Switch for Electric Door-Operating Apparatus. H. Pitts, assignor of one-half to F. M. Covert, Austin, Tex. Biased to close elevator door and controlled from car for opening door.

1,139,903. Switch. H. Pitts, assignor of one-half to F. M. Covert. Controls door operation and is controlled by position of elevator operating lever.

1,139,904. Car-Door Operating and Locking Device. H. Pitts, assignor of one-half to F. M. Covert. Sliding car door operated by electrically controlled motor.

1,139,905. Door Operating and Locking Device. H. Pitts, assignor to F. M. Covert. Gearing for operation of sliding door by reversible motor.

1,139,906. Telephone-Exchange System. L. Polinkowsky, assignor to Western Electric Co. Indication in automatic system when apparatus is busy.

1,139,917. Spark Plug Pump. F. C. H. Strasburger, Knox, Ind. Combined spark plug and pump.

1,139,948. Automatic Train-Controlling Device. L. Atwood, Farmington, Me. Sounds electric alarm on operation.

1,139,950. Insulator Bracket. F. A. Bowdle, Cerro Gordo, Ill. For fastening to side of pole.

1,139,954. Switch Box for Electric Trucks. W. C. Carr, Buffalo, N. Y. A slide has spring connection with operating rod and with the movable contacts.

1,139,956. Electromagnetic Device. E. B. Craft, assignor to Western Electric Co. Combination of operating and release magnets for telephone switchboard.

1,139,965. Electric Arc Lamp. F. W. Gore, New York, N. Y., assignor of one-fourth each to H. F. Asbury and F. Asbury. Arrangement of hanger plug contacts.

1,139,969 and 1,139,970. Water-Purifying Apparatus. H. B. Hartman, assignor to Electric Water Sterilizer Co., Scottdale, Pa. Provides for electrolyzing and electric valve control.

1,139,972. Geometrically Progressive Control System. C. J. Henschel and C. Messick, assignors to said Henschel, of Bloomfield, N. J. A receiver, operated from a distance to individually display signals, has signals operated by electromagnets the travels of whose plungers vary in geometric progression.

1,139,973. Electric Cable Terminal. G. L. Herz, Vienna, Austria-Hungary. For detachable connection with a spark plug.

1,139,976. Electric Condenser or Leyden Jar. A. N. Hovland, Christiania, Norway. Plate-shaped elements having dielectric bodies with interior and exterior metal coatings, are nested together to connect interior coating of one element with exterior coating of next.

1,139,983. Machine for Making Fiber Insulating Sheets. J. E. Lappen, assignor to Union Fibre Co., Winona, Minn. Loose fibers carried on movable foraminous apron are subjected to impact of jets of water to deflect and intertangle fibers before they are felted.

1,139,994. Warp Stop Mechanism. T. J. O'Connell, Ware, Mass. Electromagnetically controlled.

1,140,007. Time-Limit Circuit-Breaker. H. A. Steen, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Dashpot retarding member leaves liquid at end of movement and gives blow to trip.

1,140,011. Combined Gas-Engine Starter and Electric Generator. J. D. Taylor, Wilkinsburg, Pa. Storage battery and dynamo connected to engine to start engine or charge battery, and constant-loaded motor in battery and dynamo circuit during charging.

1,140,029. Stock-Gate Controller for Paper-Making Machines. T. French, assignor of one-third each to F. J. Lathan and J. W. Harris, Rumford, Me. Electrical controlling means dependent upon thickness and breakage of paper.

1,140,048. Telephone Guard. E. O. Loeber, Cleveland, O. Paper cover for mouthpiece.

1,140,050. Insulator. R. A. Manwaring and J. T. Hessel, New Haven, Conn. Single piece for pin mounting.

1,140,052. Coupling for Sectional Rods. L. L. Mast, West Milton, O. Simple coupling for lightning rods.

1,140,070. Telephone-Call Recorder. C. M. Rose, New York, N. Y. Record strip in casing has record made through opening and is subsequently presented at another opening where it may be canceled, if desired.

1,140,081. Burglar or Fire Alarm. G. Spitz, Brünn, Austria-Hungary. Circuit controlled by float in one compartment of container in room to be protected, another compartment connected with the first communicating with outside air.

1,140,093. Electric Railway System. A. Yurow, New York, N. Y. Arrangement whereby contact is maintained by plow at crossings.

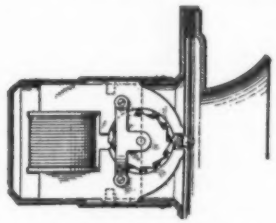
1,140,094. Plow for Electric Conduit Railways. A. Yurow. Construction of plow for use with above.

1,140,096. Non-Blinding Device. E. Aderente, Jersey City, N. J. Reflector bars in front of headlight deflect upwardly radiated light to horizontal.

1,140,106. Regulating System. J. Bijur, assignor to Safety Car Heating & Lighting Co. Voltage and current control of battery-charging generator.

1,140,120. Selective Calling Apparatus. E. B. Craft and G. Brown, assignors to Western Electric Co. Electromagnetic step-by-step device.

1,140,126. Trolley Pole. J. De Angelis, Mount Vernon, N. Y. Car-top mounting, including means for holding pole depressed.



No. 1,140,290.—Electric Horn.

1,140,131. Apparatus for Continuously Separating Solids from Liquids. J. V. N. Dorr, Denver, Col. Excessive density of liquid announced by alarm having its circuit controlled by hydrometer.

1,140,134. Incandescent Lamp. B. E. Eldred, assignor to Commercial Research Co., New York, N. Y. Construction and arrangement of composite leading-in wires.

1,140,135. Process for the Production of Compound Metal Articles. B. E. Eldred, assignor to Commercial Research Co. Relates to leading-in wires of above.

1,140,136. Low-Expansion Wire. B. E. Eldred, assignor to Commercial Research Co. Nickel-steel core with copper sheath welded thereto, whole having a less expansion than platinum. Related to 1,140,134 and 1,140,135.

1,140,150. Wireless Transmission of Electric Energy. R. C. Galletti, assignor to Galletti's Wireless Telegraph & Telephone Co., London, England. Transmitting aerial charged slowly in one sense only by connecting to terminal of direct-current generator and then impulsively discharging in one sense only.

1,140,151. Telegraphic Instrument. J. J. Ghegan, Newark, N. J. Has flexible vibrator vibrating against one contact for dots and pressed against another contact for dashes.

1,140,155. Magneto Generator. O. H. H. Heins, Edgewater-on-Hudson, N. J. Magnetic short-circuit for armature is adjustable to standardize circuit through armature.

1,140,165. Signaling Device for Elevators. H. L. Kilbourne, Memphis, Tenn. Floor and elevator signals operated from car and floors.

1,140,214. Charging Railway System. G. E. Titcomb, assignor to Link-Belt Co., Chicago, Ill. Two cars on two tracks and a controller for each on one car.

1,140,227. Railway Signaling Apparatus. W. Wright, Kalgoorlie, Western Australia, and L. Langford, South Yarra, Victoria, Australia. Current collector for establishing circuit from car to wire along way.

1,140,229. Vehicle Direction-Indicator. A. W. Youngkvist, Duluth, Minn. Signals selected by sliding shutter.

1,140,230. Switch for Electric Conduit-Railways. A. Yurow, New York, N. Y. Contact piece at switch automatically actuated before plow reaches it.

1,140,247. Electric Compensator. G. A. Burnham, assignor to S. B. Condit, Jr., Boston, Mass. To maintain voltage, generator field circuit is varied by make-and-break mechanism through variable-speed device responsive to main voltage.

1,140,248. Time-Limit Controlling Device for Electric Switches. G. A. Burnham, assignor to S. B. Condit, Jr. Series motor set in operation on overload moves switch actuator from initial position.

1,140,249. Time-Limit Relay. G. A. Burnham, assignor to S. B. Condit, Jr. Modification of above.

1,140,263. Loud-Speaking Telephone. W. Harrisson, New York, N. Y. Transmitter circuit has arc supplied with hydrogen controlled by sound-actuated diaphragm.

1,140,290. Signal Horn. S. Scognamillo, New York, N. Y. Electric motor has toothed wheel for vibrating diaphragm. (See cut.)

1,140,310. Process for Recovering Elemental Sulphur from Sulphur Gases. W. F. Lamoreaux and C. W. Renwick, Isabella, Tenn. Sulphur dioxide is mixed with atmospheric oxygen in contact with carbon made incandescent by passage of electric current.

1,140,317. Current-Diverter. T. D. Robinson, assignor to Amper Electric Co., Lockport, N. Y. In an ignition system sparking elements in secondary circuit are short-circuited when primary circuit is inoperative.

1,140,322. End-Cell Switch. J. W. Achard, Philadelphia, Pa. A sliding contact makes electrical connection with two adjacent contacts through high resistance in passing from one contact to other.

1,140,329. Telephone Signaling System. E. A. Mellinger, Chicago, Ill. Automatic switch for connecting subscriber's line and signal operated upon replacing of receiver.

1,140,333. Typewriter Carriage-Return Device. O. Brisbois, assignor of 51 per cent to J. H. Ware, Chicago, Ill. Operated by automatically controlled electric motor.

Patents Expired.

The following United States electrical patents expired on May 24, 1915:

604,358. Valve-Controlling Device. W. S. Alexander, New York, N. Y.

604,373. Automatic Telephone Exchange. W. Decker, Owego, N. Y.

604,384. Electric Heater. E. E. Gold, New York, N. Y.

604,418. Accumulator Plate. I. Rosler, Berlin, Germany.

604,431. Electric Signal for Railway Crossings. L. C. Smith, Columbus, O.

604,434. Telephone Signal System. W. A. Stilwell and A. Barneck, Salina, Kans.

604,453. Secondary Electric Clock. A. D. Blodgett, Newton, Mass.

604,459 to 604,466. Electric Meter. T. Duncan, Fort Wayne, Ind.

604,471. Electric Brush. E. M. Hellwig, Chicago, Ill.

604,499. Multiple Telephony and Telegraphy. R. Pfund, New York, N. Y.

604,501. Motor Wattmeter. C. D. Raab, Kaiserslautern, Germany.

604,508. Electric Clock. W. Whitehead, Manchester, England.

604,511. Driving Mechanism for Dynamos. P. W. Alexander, Allapaha, Ga.

604,533. Combined Transmitter and Receiver. J. M. Joy, New York, N. Y.

604,544. Electrical Governor. M. A. Replogle, Akron, O.

604,588. Storage Battery. H. S. Lloyd, Philadelphia, Pa.

604,616. Automatic Resetting Fusible Cut-out. J. D. Holmes and W. L. Heath, St. Louis, Mo.

604,626. Electrical Lighting Device for Kerosene or Other Burners. S. M. Meyer, Brooklyn, N. Y.

604,679. Incandescent Electric Lamp Regulator. D. McF. Moore, New York, N. Y.

604,680. Electric Lamp Regulator. D. McF. Moore.

604,681. Interrupter for Electric Lighting Systems. D. McF. Moore.

604,682 and 604,683. Magnetic Circuit-Breaker. D. McF. Moore.

604,684. Automatic Vibratory Interrupter. D. McF. Moore.

604,685. Electric Lighting Apparatus. D. McF. Moore.

604,686. Apparatus for Producing Luminous or Similar Effects. D. McF. Moore.

604,687. Circuit-Interrupting Mechanism. D. McF. Moore.

604,688. Circuit-Interrupter. D. McF. Moore.